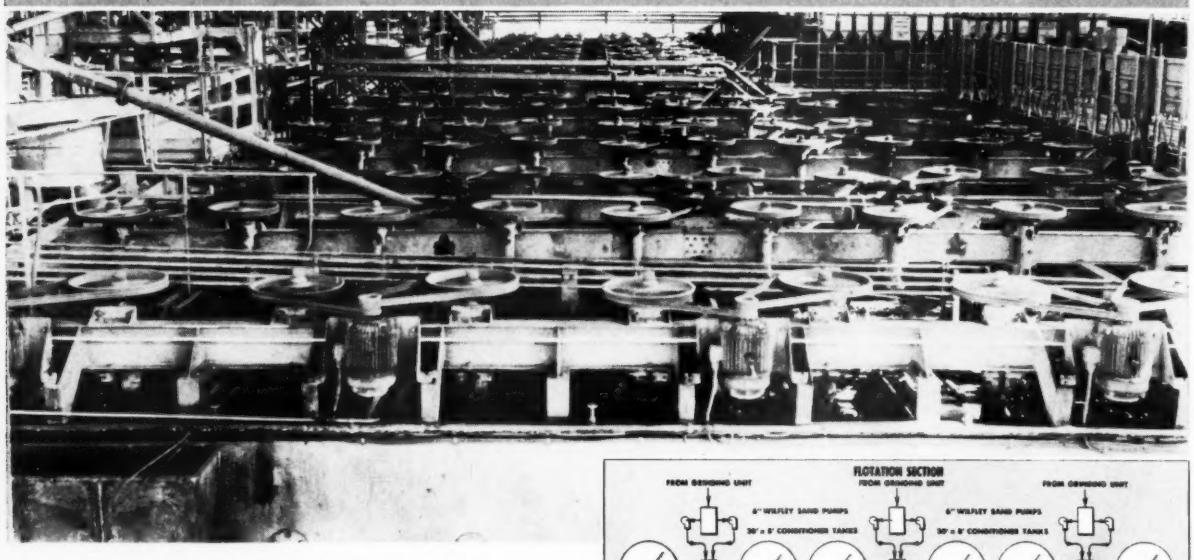
Mining

AMC

CONGRESS JOURNAL

886 DENVER "SUB-A" FLOTATION CELLS

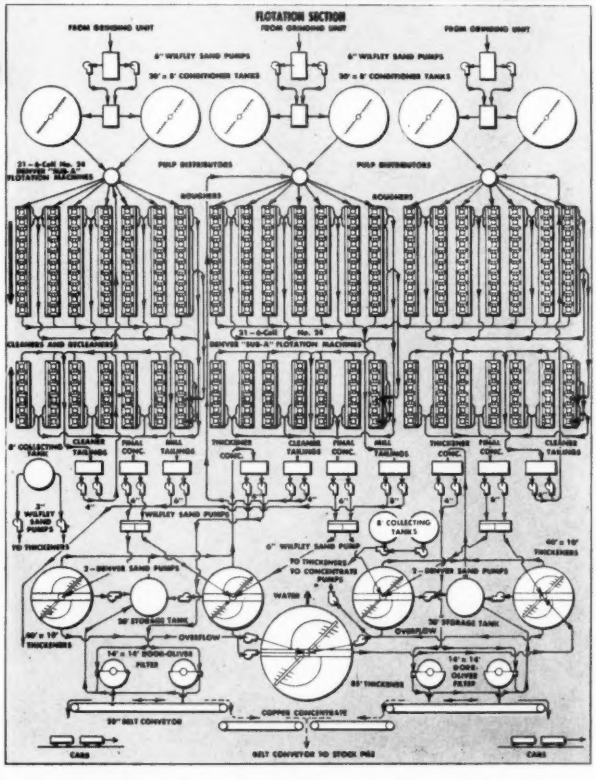


in continuous operation at the UNION MINIERE du HAUT-KATANGA!

This great South African mining operation has been steadily ordering DENVER "SUB-A" FLOTATION CELLS since 1939 . . . and now has 886 profit-making cells in operation!

The continued re-ordering of more and more DENVER "SUB-A" FLOTATION CELLS is graphic testimony pointing out the ruggedness and simplicity of their efficient operation! Here . . . or in any other part of the world where skilled labor and replacement parts might be a problem . . . DENVER has been selected OVER AND OVER AGAIN . . . thanks to their dependability and quality of operation!

R. E. "Bob" Hancock, Sales Engineer for DECO, stands ready to assist you in any of your mining or mill problems. For the complete story on the tremendous U.M.H.K. operation at their Kolwezi concentrator, send for DECO Engneering Notebook Bulletin #M4-B63.



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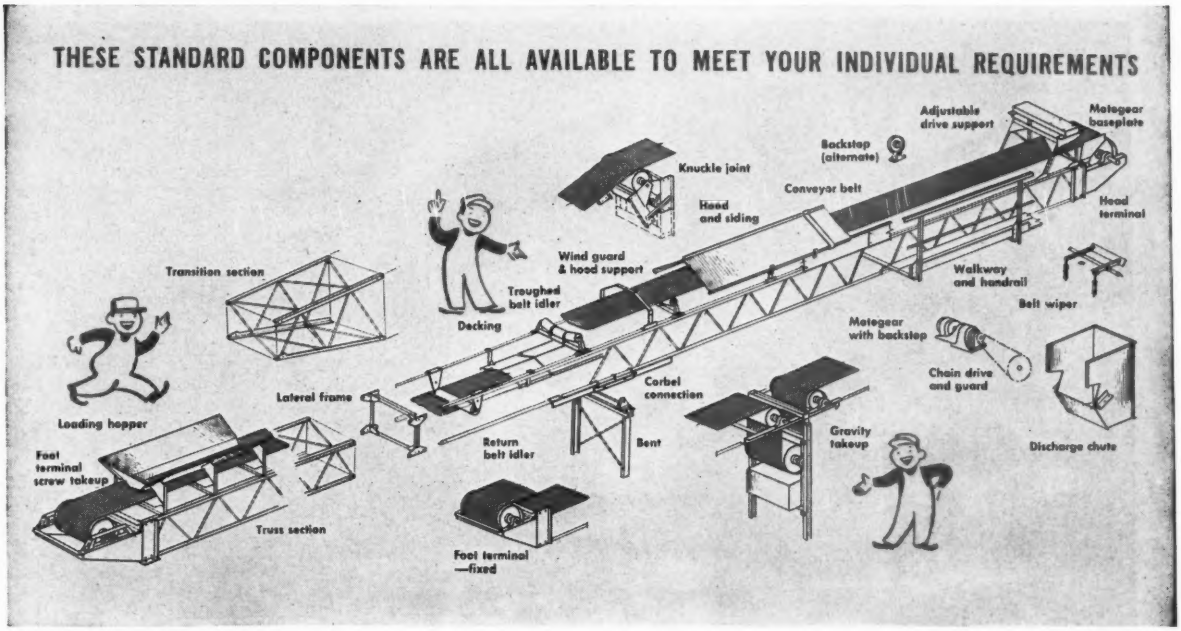

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PRE-BILT PACKAGE

easy selection

Your Link-Belt representative will help you select the best combination of PRE-BILT sectional belt conveyor components.

Standard 18, 24, 30 and 36-inch widths need no special engineering

Here's an economical, standardized belt conveyor "package" . . . ready to meet the majority of belt conveyor needs and perform dependably for years and years. It combines standard Link-Belt products with sectional truss frames and steel supporting bents.

Book 2579 has further data on Link-Belt PRE-BILT conveyors . . . with drives up to 40 hp and 24 and 42-inch truss depths. Write today, or ask for a copy at your nearest Link-Belt office.

LINK-BELT

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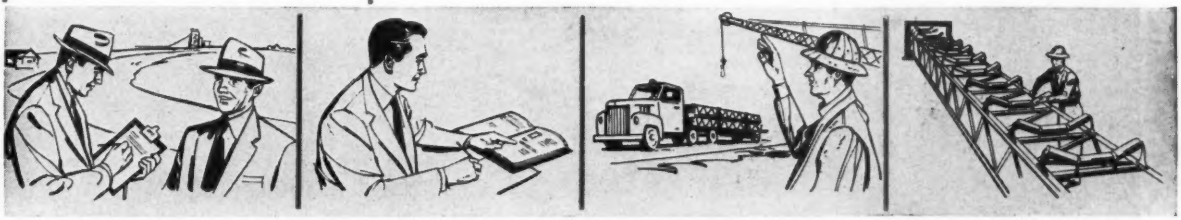
BELT CONVEYOR EQUIPMENT



prompt quotations

He will prepare a comprehensive and accurate estimate of requirements for installations that permit "on-the-ground" survey.

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Parts are standardized, interchangeable, all available from one supplier. Link-Belt representative can furnish all data.

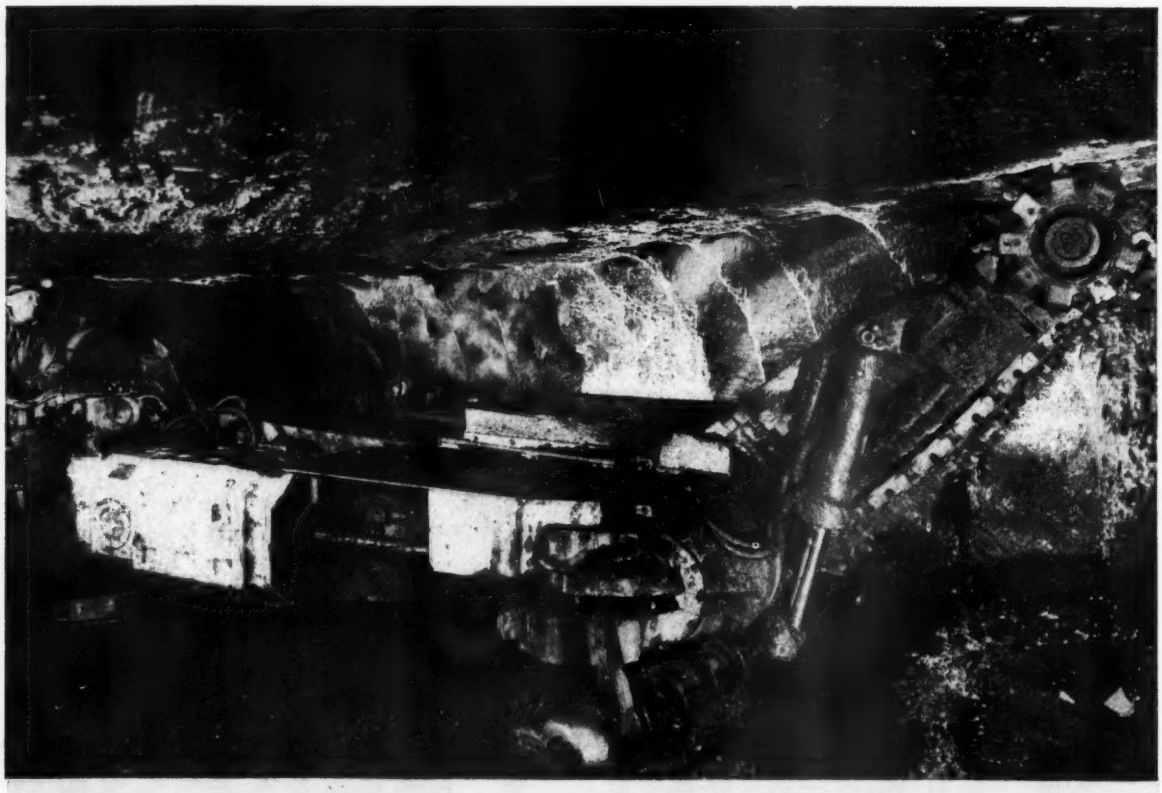
quick delivery

PRE-BILT conveyors are built at nine strategic locations throughout the country and are shipped from the plant nearest you.

fast installation

Can be readily handled by your own erectors in most cases. Link-Belt can also furnish complete erection service and supervision.

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

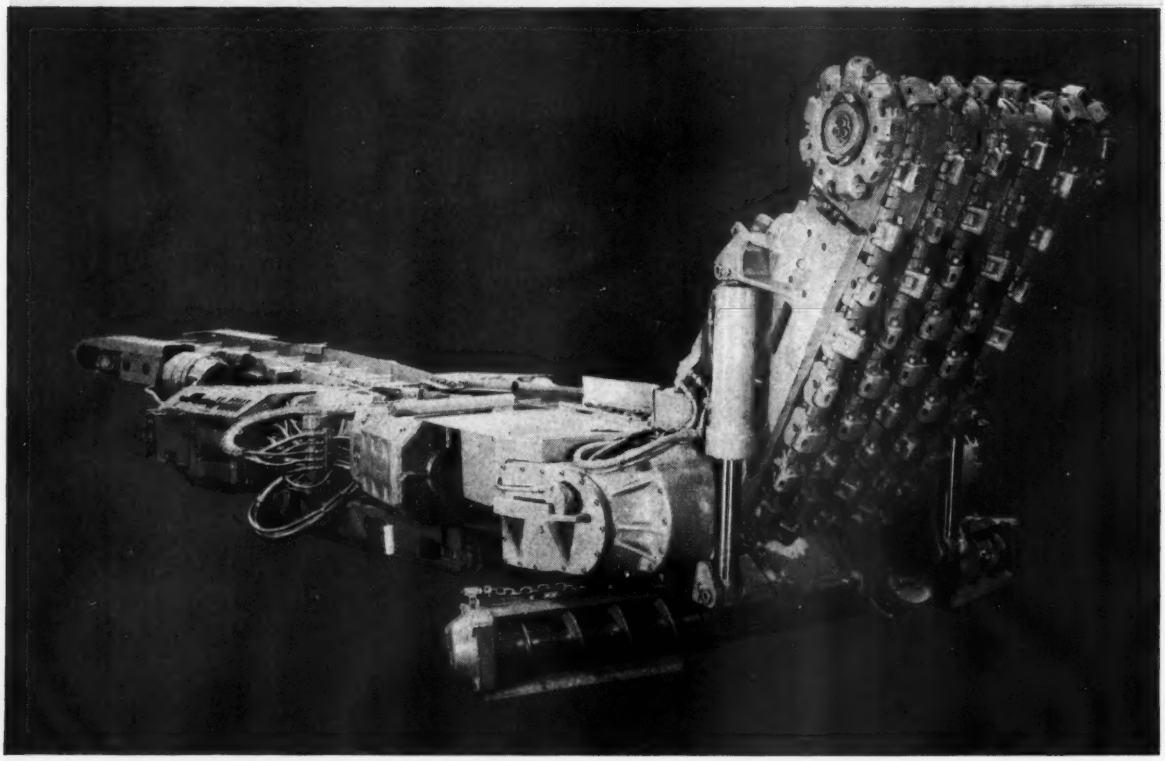


REACHES UP TO 82" FROM FLOOR

The 5-CM gets its long reach from a long 5' ripper head and a deep (24") sumping stroke. Two 100 horsepower motors take care of this heavy work load.

EXTRA-WIDE RIPPER HEAD

A full 42 inches across delivers more coal per cut—fewer cuts per complete face cycle. New direct-acting hydraulic shear jacks and swing jacks supply the "punch."

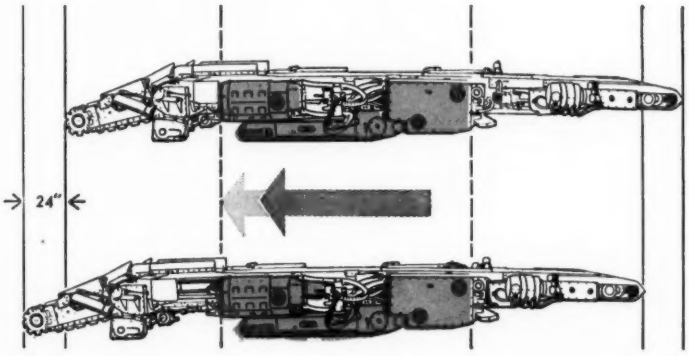


NEW JOY LOW MINER

DELIVERS 4 TO 5 TONS PER MINUTE

JOY 5-CM MINES SEAMS AS LOW AS 38"

Now, even more mines can get the full advantages of continuous mining with the introduction of Joy's new 5-CM. This low (32") Continuous Miner works up to 82" from the floor. It's a close cousin to earlier, time proved Joy miners . . . yet has many new advances that permit a low height machine to deliver such high tonnage.



24 INCH SUMP

With every sumping operation the 5-CM enters a full 24 inches into the face . . . delivers extra tons for every operating cycle of the ripper bar as it sweeps across the working face.

CONTINUOUS CONVEYOR

The drawings at left show how the entire ripping and conveying systems of the miner move forward as one unit during sumping. There is no hopper—just one extra-wide (29½") chain conveyor that moves coal swiftly away from the face.

There's lots more—increased power . . . hydraulic tramming—improved clean-up conveyors. Get complete details on this new miner designed to mine 4 to 5 tpm in medium-low seams 38-inches and higher. Write ***Joy Manufacturing Company. Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WRITE FOR FREE BULLETIN 169-3

and

See it at the Coal Show in Lakeside Hall

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CONTINUOUS MINERS

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CUTTERS

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FOR THE FIRST TIME a complete operating exhibit of the H & P Circuit—the new money-saving method of fine coal washing and water clarification.

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- Closed water circuit operation where desired

We invite you to come to the HEYL & PATTERSON Booth No. 207 and witness a brief demonstration of the H & P Circuit. Then visit with our Sales Engineers and ask them for facts and figures—operating facts and dollar savings!

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APRIL, 1957

VOLUME 43 • NUMBER 4

Mining

CONGRESS JOURNAL

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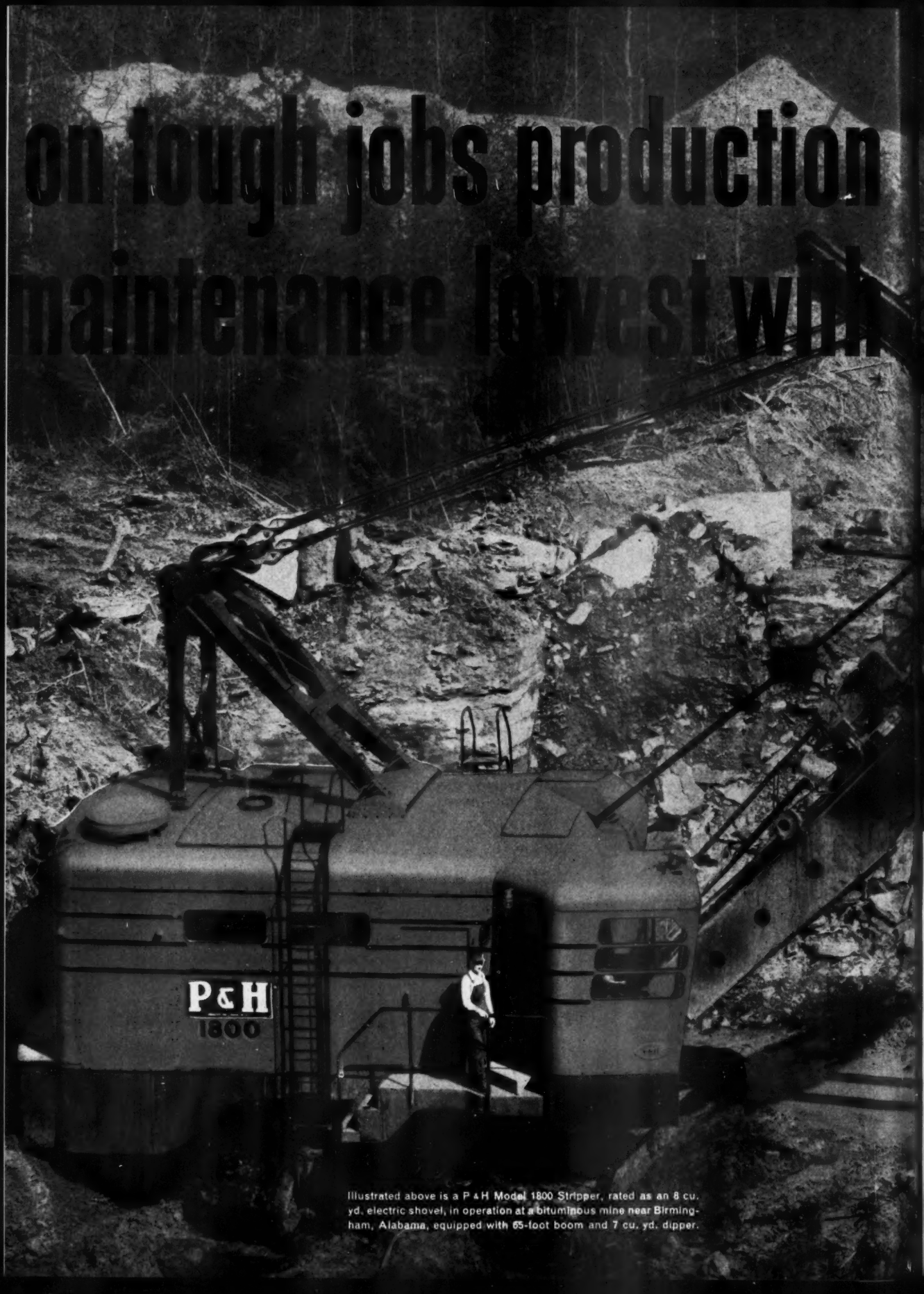


Illustrated above is a P & H Model 1800 Stripper, rated as an 8 cu. yd. electric shovel, in operation at a bituminous mine near Birmingham, Alabama, equipped with 65-foot boom and 7 cu. yd. dipper.

When the going gets the toughest in stripping overburden in rugged terrain there is nothing like this P&H Model 1800 stripper for profitable production.

P&H is first choice among coal mine operators worldwide because of P&H exclusive features like MAGNETORQUE* and ELECTRONIC CONTROLS.

MAGNETORQUE . . . transmits power from the hoist motor to the dipper electromagnetically for faster action, and at the same time, eliminates shock and impact to the hoist gear train and motor. Response is immediate to varying load conditions.

ELECTRONIC CONTROLS . . . P&H designed and built to provide fastest action of any type of control available on electric shovels. All motions are smoother, resulting in consistently higher output.

Magnetorque and Electronic Controls mean reduced maintenance and greater availability. With P&H you get single source responsibility . . . another distinct advantage experienced only by users of P&H Electric Shovels. P&H designs, manufactures and applies all electric rotating equipment specifically for electric shovel service.

*T. M. of Harnischfeger Corporation for electro-magnetic type coupling.

HARNISCHFEGER
CONSTRUCTION & MINING DIVISION
Milwaukee 46, Wisconsin

P&H ELECTRIC SHOVEL LINE:
3½ through 8 cu. yd. capacities

SEE THE P&H EXHIBIT AT **BOOTH NO. 701**
American Mining Congress Coal Show
Cleveland, Ohio, May 13-16

Okocord Red Saddle shuttle car cable is the answer to:

constant flexing • run-overs • abrasion pulling • twisting

Conditions in individual mines vary. But you can be sure that you have a shuttle car cable that will resist all of these difficulties if yours is Okocord Red Saddle shuttle car cable (with Hex-Tite construction, of course).

The Red Saddle is a pre-formed neoprene protective wall which assures a uniformly thick fill between conductors . . . gives added security against short-circuiting during run-overs.

What's more, there's no danger of internal slipping or rotation with Hex-Tite construction. For the insulation of each conductor is hexagonally shaped to provide six plane surfaces which lock with the Red Saddle and Okoprene sheath. Bonding between all elements is assured by a special adhesive.

Naturally, the Okoprene sheath is tough, highly flexible and is unaffected by oils, acids, alkalies and mine water.

These features—plus others such as the heavy reinforcing cords embedded in both insulation and sheath as a further guard against pulling damage—are all good reasons why we believe Okocord Red Saddle, using the Hex-Tite construction, is your best buy in shuttle car cable.

You'll find complete information about this rugged construction in Bulletin MC-450. Write today for your copy to The Okonite Company, Passaic, N. J.

VISIT OKONITE'S DISPLAY AT COAL SHOW—BOOTH NO. 1300

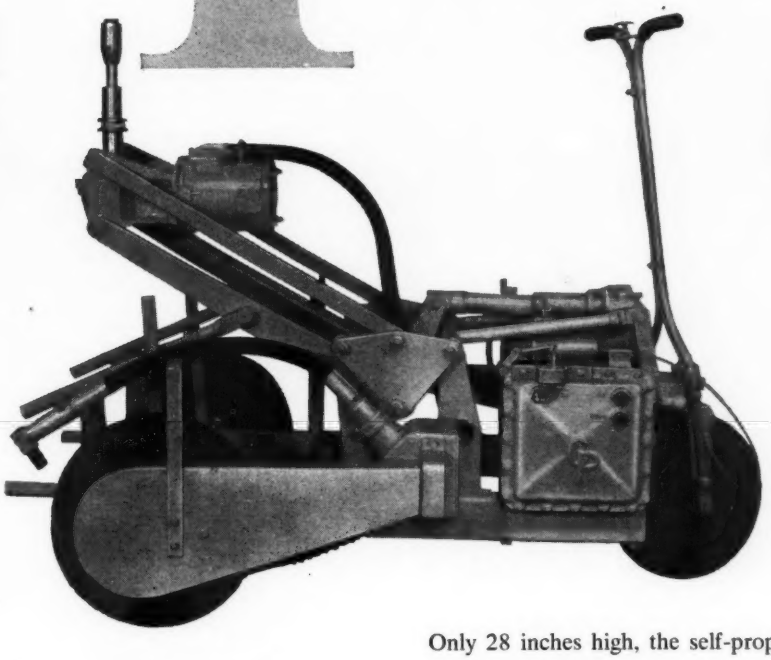
where there's electrical power... there's **OKONITE CABLE**

IN 3 MINUTES THE CP ROOF BOLTING UNIT...

1 • trams into a seam under its own power

2 • sets expansion bolt without repositioning

3 • drills hole at 4 feet per minute



VISIT BOOTH 1713
AT THE COAL SHOW

These EXTRAS are available:

- Special low-speed spindle attachment for slow-speed drilling
- Low-seam drilling attachment for low-coal

Only 28 inches high, the self-propelled RBD-30-S is ideal for use in low coal, takes high seams in its stride – even drills slate, shale and laminated limestone without delays. A power take-off from auger and bolt-setter motor powers a totally enclosed drive gear. Tramming control is within easy reach between guide arm handles. Telescopic chuck has a 6-inch auger adjustment to conform to roof irregularities. Built-in slip clutches prevent stalling . . . wheel locks prevent unit from shifting position.

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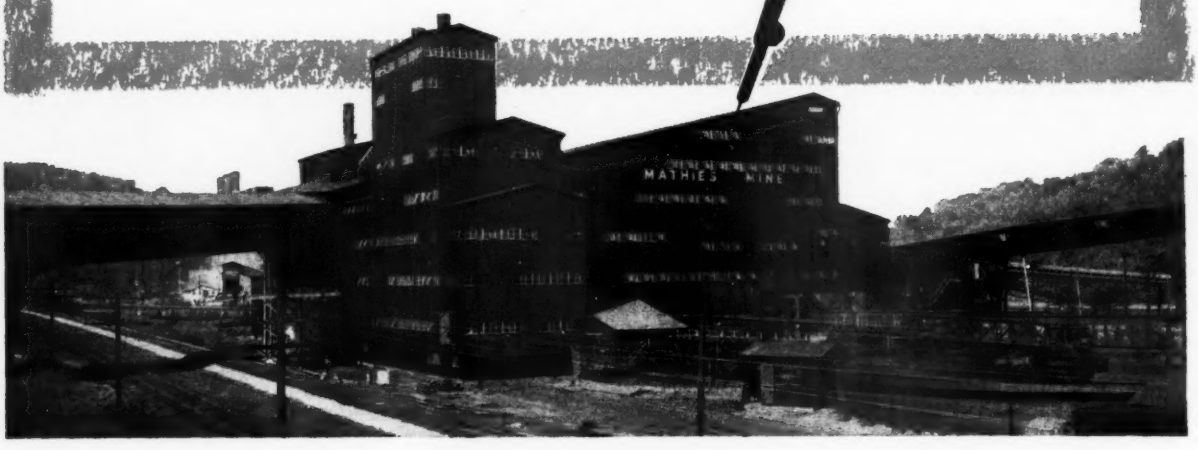

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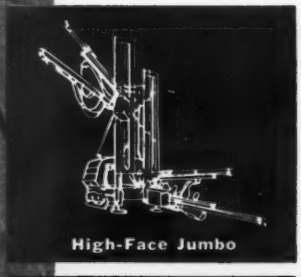

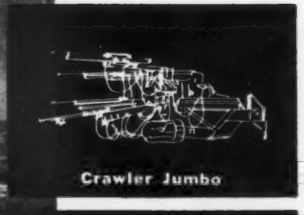

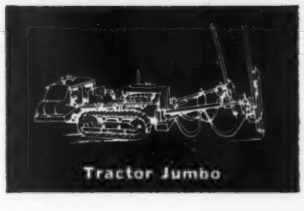

no matter HOW BIG or how small the drilling job

you can do it faster and easier with an I-R HYDRA-BOOM JUMBO

THE giant, octopus-like drill jumbo above was supplied by Ingersoll-Rand for a large shaft-sinking job. Carrying six heavy, boom-mounted I-R drills, each with individual, fingertip control, it is lowered down the shaft as drilling progresses — virtually eliminating setup time and giving maximum footage per shift.

Other typical Hydra-Boom jumbos, manufactured by Ingersoll-Rand Co. are shown above right and illustrate the *unlimited flexibility* of these fast-acting, hydraulically-operated drill mountings. Use them on large jobs or small — for smooth, effortless hole spotting. Let us help you engineer your unusual drilling problems. For the complete, cost-saving story, write today for Bulletin No. 4162.

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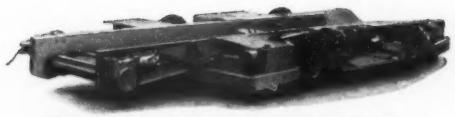
and **JEFFREY BELT CONVEYORS**
for speedy, low cost coal transportation

A Jeffrey Class 66 shuttle car discharges coal directly into a Jeffrey 80-A belt conveyor at a large Kentucky mine.

Choose from these three classes of JEFFREY SHUTTLE CARS to match your mining height

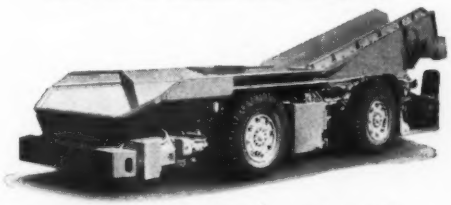
They carry big payloads and haul the coal away *fast.* 4-wheel drive, 4-wheel steering and 4-wheel braking make them safe and easy to maneuver under every mining condition. All have hydraulically driven conveyor and cable reel. Conveyor can be run slow for "jogging" when loading, slow or fast when unloading, and its direction can be reversed.

Jeffrey shuttle cars are built for continuous, rugged service.



Class 68 in heights from 24" to 32"

Class 66 in heights from 30" to 48"



Class 67 in heights from 48" to 60"
Class 90 in heights from 44" to 56"

...and BELT CONVEYORS to meet your exact requirements from the complete Jeffrey line

Three types of head sections can be combined with three types of frames, giving you nine combinations to meet any belt conveyor requirement. Jeffrey engineers will help you select the right combination for each gathering, slope or main line haulage job.

These three husky head sections can transmit from 25 to 160 HP for belt speeds from 150 to 600 FPM. Tandem drive puts the conveyor belt in maximum contact with two gear-meshed drive pulleys for most efficient use of power on a long pull.

The three frames are built for belt widths from 26" to 36", and idler roll sizes range from $2\frac{9}{16}$" to 6" dia.

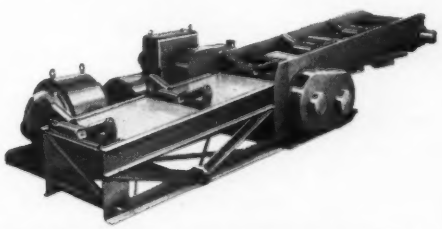
With Jeffrey shuttle cars and belt conveyors, you are assured of high-tonnage handling at low cost, less downtime and low maintenance.

The Jeffrey Manufacturing Company Columbus 16, Ohio

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

52-B Head Section for 25 to 75 HP motors. 52-B frames are made for 26", 30", and 36" belts, and $2\frac{9}{16}$" or 4" diameter idler rolls.



64-A Head Section for motors up to 125 HP. 64-A frames are made for 30" and 36" belts, with 4" diameter idler rolls.

80-A Head Section for motor drives up to 160 HP. The 80-A frame is adaptable to 30" and 36" belts, and 4", 5" or 6" dia. idler rolls.

CONVEYOR BELTS

Visit our Booth No. 801 and Entertainment Suite at the American Mining Congress, Cleveland, May 13-16

"Getting coal from the mining machine to the main haulageway used to be one of our main problems," says an executive of Old Ben Coal Corporation. "Then we installed an extensible system of conveyor belts. This eliminated the time-consuming job of continually moving the pit car and putting down and pulling up railroad track to keep up with the mining operation."

Long known in the coal industry as a progressive outfit, Old Ben chose U. S. Conveyor Belts because of the good job they were doing in their preparation plants above ground and because of the belts' proven performance on extensible conveyor systems.

These belts have made a hit with Old Ben officials in every way. Output has gone up 10% and the belts are practically maintenance-free.

This extensible conveyor* has idlers suspended from wire ropes. The 36" U. S. Giant® MineHaul Belt (Style EN) in use here, provides just the right amount of flexibility to complement this new extensible conveyor system. The belt's resiliency and troughability keep it perfectly trained all the time.

For any materials handling problem, there is a "U.S." belt—plus expert engineering assistance—available at any of the 28 "U.S." District Sales Offices, at selected "U.S." distributors, or write us at Rockefeller Center, New York 20, N. Y.

In Canada, Dominion Rubber Co., Ltd.

*Manufactured and patented by Goodman Mfg. Co.

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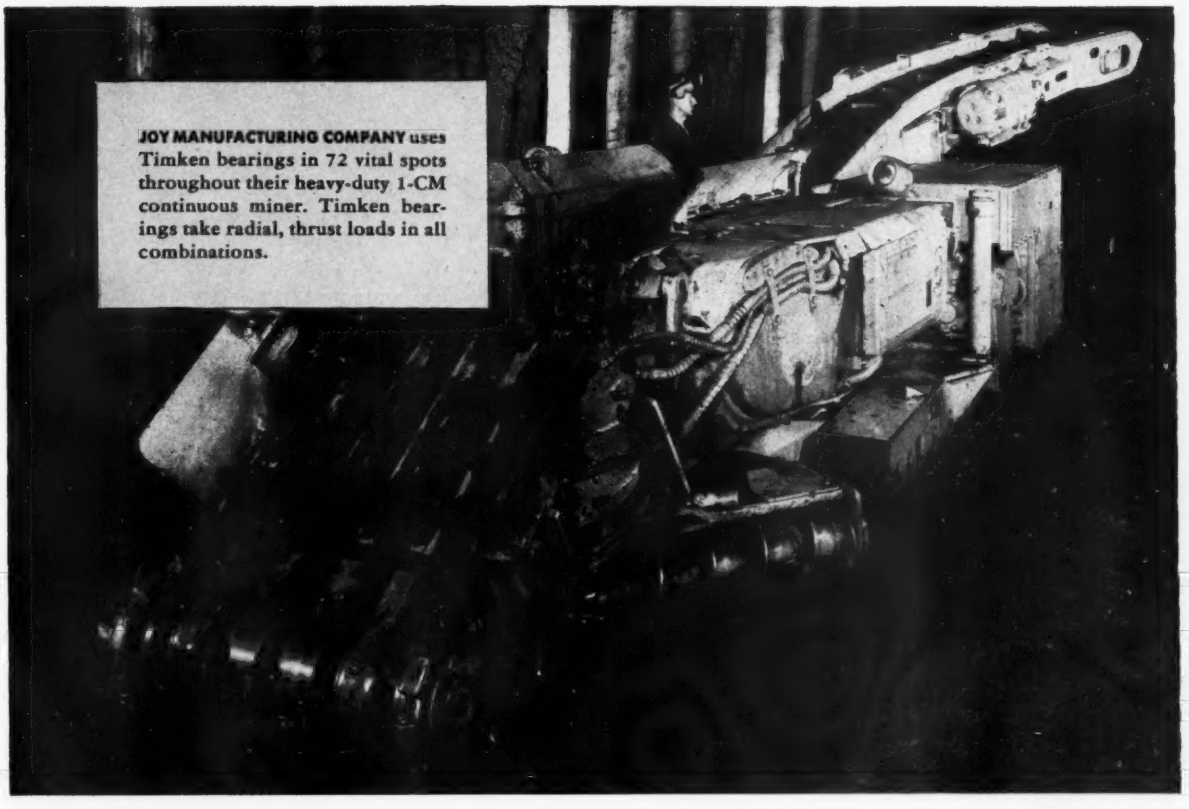
JOY MANUFACTURING COMPANY uses Timken bearings in 72 vital spots throughout their heavy-duty 1-CM continuous miner. Timken bearings take radial, thrust loads in all combinations.

Coal mine production jumps for joy—when TIMKEN® bearings roll up 17,818 tons in a month

USING Joy Manufacturing Company's 1-CM continuous miner, a West Virginia mine—in a regular month of operation—brought up 17,818 tons of raw coal. This was an average shift production of 457 tons, and an average production *per man-shift* of 53.8 tons . . . a 40% increase over conventional methods. Built for heavy-duty operation and high-tonnage production, the Joy 1-CM keeps rolling up record production with Timken® bearings in *72 vital spots:* idler head, speed reducer clutch, power take-off, crawler assembly, scroll drive, bar gear case, pump drive reducer, etc.

Tapered construction lets Timken bearings take heavy radial and thrust loads in all combinations. Full line contact between rollers and races gives extra load-carrying capacity. Rollers and races are case-carburized, with hard, wear-resistant surfaces over tough, shock-resistant cores—take tremendous shock loads. Timken tapered roller bearings make closures more effective by holding shafts concentric with housings. This means dirt, coal dust, water are kept out while lubricant stays in.

Friction is practically eliminated. Timken bearings are geometrically designed to give true rolling motion, and precision-made to do exactly that in service. We go one giant step beyond all other American bearing makers in quality control—we make our own steel. Design, precision-manufacture, rigid inspection and control of quality from melt shop to finished bearing all mean you get the finest when you specify "TIMKEN" on every bearing!

The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

See us at the 1957 COAL SHOW
May 13-16, Public Auditorium, Cleveland, Ohio
BOOTH NO. 900

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Depend on American Cyanamid to meet all your explosives requirements from its complete line.

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Split-Second Delay
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Rubber-tired tractor works fast on watery pit floor

A large Ohio quarry, producing 700,000 tons of limestone yearly, uses one rubber-tired Tournatractor to handle all clean-up and pit maintenance. The tractor covers 325 acres ...maintaining and building haul roads, moving freight cars, pushing in toe of stockpiles, bunching blasted stone, cleaning around shovel.

6" of water, no barrier

A few days before these pictures were taken, heavy rains left as much as 6 inches of water on the quarry floor. Rolling easily on its big 21:00 x 25 low-pressure tires, the tractor maneuvered in and out of the watery loading area, handled its assignments quickly and efficiently.

A major Tournatractor advantage when working in rain and water is that all moving parts in its power train are completely enclosed. They operate in a constant bath of oil, sealed against moisture. Lubricants stay in to prevent corrosion and maintain machine's high-operating efficiency and low-maintenance cost.

"Beats crawler on rock"

Foreman Bernard Boli said, "Tournatractor has crawler beat all to pieces on rock... gets around 1¼-mile quarry easily. Our biggest reason for buying the Tournatractor was speed." And operator Charles A. Slover said, "Tournatractor is a wonderful machine for the operator. It doesn't beat you around like a crawler. Besides lubricating quickly, and being able to move six 45-ton-load cars, I like the ease of riding."

Perhaps you can use a 210 hp rubber-tired tractor

To handle widely scattered dozing, pushing, and clean-up assignments, let Tournatractor help you speed operations, save you money. Let us show you owner-verified performance records of Tournatractor on work similar to yours.

▲ Tournatractor moves in between shovel-swings to clean up spillage and doze blasted stone for easier loading. Shovel cycle is not interrupted, because of rubber-tired tractor's sure-footed speed to 17 mph on uneven pit floor.

Tournatractor handles dozing quickly . . . gets good bladeful of rock, moves about 2½ cubic yards in 30-ft. dozing run. Versatile machine handles many other quarry assignments, pushes in blasted stone, cleans up around stockpiles, pulls other equipment around quarry. ▼

Versatile Tournatractor dozes overburden between cleanup and other assignments. Shovel in background removes 6' to 10' of overburden. Tournatractor quickly cleans stone shelf so that production shovels can move in. ▼

Tournatractor—Trademark Reg. U.S. Pat. Off. T-997-Q-bw

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

Note to Mining Men:

TO GET A NEW SLANT
on IRWIN MAN-VANS...
8 WHEEL "STREAMLINERS"
...4 WHEEL TRUCKS...on
HUWOOD-IRWIN BELT
CONVEYORS and see for
the first time the
TCR MINE PROPS

STOP
at Booth 735

American Mining Congress
Cleveland
May 13 to 16

IRWIN FOUNDRY & MINE CAR CO.

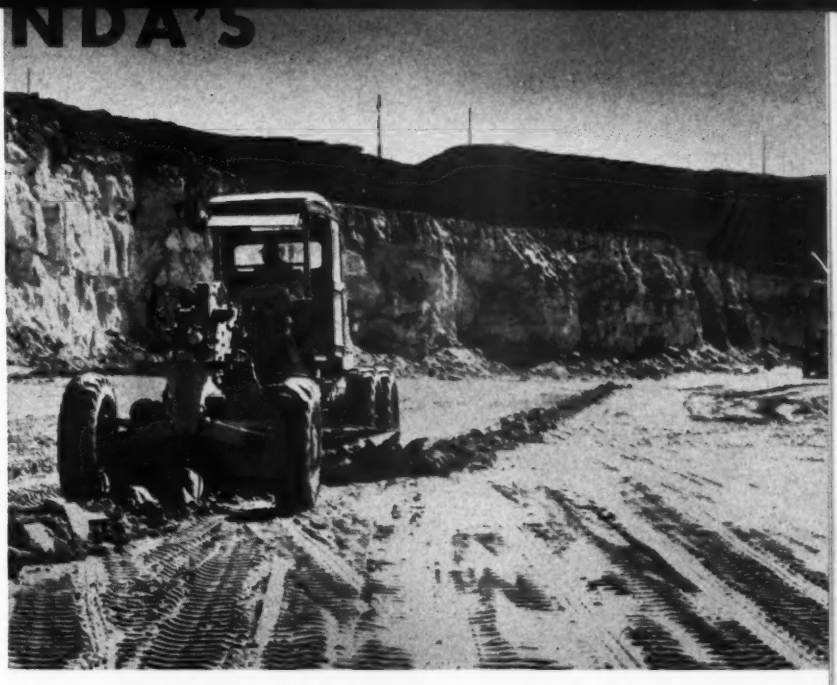
•

HUWOOD-IRWIN CORP.

IRWIN, PA.

At ANACONDA'S Jackpile uranium mine:

30 miles of hauler-worn roads patrolled by ONE Adams* 550

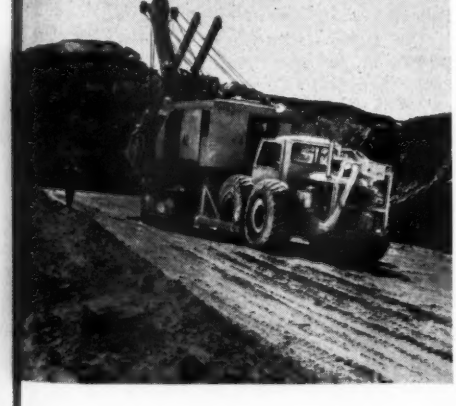


At New Mexico uranium mine, debris dropped by passing haul units is quickly bladed aside by Adams 550 grader. Anaconda Company assigns this versatile unit to the job of keeping 25 to 30 mi. of pit haul-roads smooth and well-drained. These roads take pounding of heavy haul units 6 days a week.

Anaconda Company's 30 miles of pit haul-roads at its Jackpile uranium mine near Laguna, N.M., take the continual pounding of big haul rigs 16 hours a day, 6 days a week. To level and smooth these road surfaces — Anaconda uses one man and one machine: an Adams 550 grader.

This big 123 hp, 26,370-lb. rig has the power, weight and speed to handle the job fast and accurately. Its 8 forward and 4 reverse gears always give the operator "just right" power-speed ratio to work any type of material . . . give it high travel speeds to move fast to new jobs.

210 hp, 17 mph SwitchTractor helps one of Anaconda's big power shovels travel up an adverse grade. Main duties of this coupler-equipped tractor are heavy dozing at the pit, and switching of ore cars at the railhead.



Levels roads, clears away debris

At the pit, 6 power shovels work continuously to load 26 heavy-duty hauling units. A steady stream of heavy hauler traffic flows over the network of roads connecting Anaconda's pit with its various dumps and stockpiles. The fast-moving Adams grader patrols these busy roads; goes wherever needed to fill ruts, level ridges, clear debris sifting down from banks or dropped by over-loaded haulers.

Operator uses "550's" big 12′ wide blade to work loads of chipped rock, clay, and earth. Blade is fully rotatable on the circle . . . can be extended a full 7½′ outside line of wheels for shouldering. To trim banks, grader has a vertical reach of 12½′ . . . cuts at angles to 90°.

Utility SwitchTractor* dozes, switches

Anaconda uses another LeTourneau-Westinghouse unit to doze heavy clean-up around shovels, and for switching of ore cars at the railhead. It's the 210 hp, 17 mph SwitchTractor — a mobile, rubber-tired rig equipped with heavy-duty dozer blade in front, and a standard rail-car coupler in the rear. Dozer-switcher moves around wherever needed, handling a variety of jobs.

Cuts operating costs

Any pit operation shows more production . . . more profit . . . when a continuous pit and road clean-up policy is followed. Heavy-duty Adams 550 grader — with its wide selection of speeds — affords you dependable one-machine service in this important maintenance job. Like other big Adams graders, the "550" has a combination of operating features not found in any competitive unit. Ask for complete details.

An Adams Grader for every size job

New POWER-Flow 660* — 190 hp with torque converter	30,200 lbs.
Model 660* — 150 hp diesel	30,050 lbs.
Model 550* — 123 hp diesel	26,370 lbs.
Model 440* — 104 hp diesel	24,080 lbs.
Model 330* — 80 hp diesel	23,020 lbs.
Model 220 — 60 hp diesel	15,500 lbs.

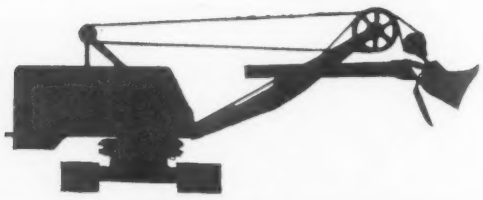
*Choice of GM or Cummins engine
(Weights shown are usual working weights.)

*Trademark AGST-1245-M-b-5

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT



WHEN THE DIGGING GETS REALLY TOUGH

Patent Applied for

ESCO WEAR CAPS CUT ADAPTER REPLACEMENT COSTS!

ESCO replaceable Wear Caps protect point adapters for long-wearing life.

Wear Caps are rugged, heat treated, high Brinell, 12M Castings, that slip over the top front of the adapter to protect the adapter from abrasive wear.

Replace the cap and not the adapter.

Designed specifically for large shovels, to cut adapter replacement in hard rock and other extreme conditions.

See your nearest ESCO dealer.
Ask for ESCO Tested Points Catalog No. 187.

ESCO

ELECTRIC STEEL FOUNDRY COMPANY

2178 N. W. 25TH AVE. • PORTLAND 10, OREGON
MFG. PLANTS AT PORTLAND, ORE. AND DANVILLE, ILL.
Offices in Most Principal Cities
ESCO INTERNATIONAL, NEW YORK, N. Y.
IN CANADA ESCO LIMITED

No hydraulics to break, leak or freeze-up!
No small front steer-wheels to align!
No tie-rods to bend!
No springs to break!
No frame to warp!
No long drive-shaft to maintain!

Cuts your hauling costs!

Tournapull Rear-Dump overcomes most maintenance problems of conventional haulers

Construction of Tournapull Rear-Dump is radically different (and much simpler) than that of a conventional heavy-duty hauler. In place of a foundation frame and body sub-frame, Tournapull Rear-Dump hitches rear and front wheels through a horizontal yoke extending back from the kingpin, and pivoted to body itself just above and ahead of rear wheels. Body is simpler, much stronger . . . has no frame and sub-frame to get out of line.

Look at the photo above . . . note the absence of springs, spring hangers, and tie rods. Low-pressure tires adequately absorb the shocks of rough haul-road travel and shovel loading. Eliminated are spring maintenance, replacement time, and cost of spring parts.

Front-wheel drive and kingpin-type power steer helps simplify Tournapull construction, too. No longer must power be carried back to the rear through a drive-shaft. Bearing and lubricating problems of a long drive-shaft are eliminated. No longer is steering handled by small front wheels subject to "bulldozing" and misalignment. There are no tie rods, no hinged steering connections to become twisted or bent.

Nor do you have the troubles of hydraulic hoists or gravity dumping with these Rear-Dumps. Dump is by an electric winch, that lifts the body up on twin cables. Operation is under complete control at all times — with positive power for dump and return controlled by an electric switch on the dash. There are no oil seals, hydraulic pumps . . . no high-pressure lines and jacks to keep tight . . . no freezing up in cold weather as with hydraulics. There are no shock loads as in gravity dumping. You save on regular maintenance time because there is no hoist mechanism to check . . . only a few places to inspect and lubricate.

Let us show you how these savings can put money in *your* pocket. For proof, we'll be glad to show you performance figures from a job like yours. Or, if you wish, we'll give you names and addresses of nearby owners of Tournapull Rear-Dumps, so you can check the facts for yourself.

Model D — 11 tons, 138 hp

Model C — 22 tons, 208 hp

Model B — 35 tons, 293 hp

Now available with optional tailgate. Prime-mover also powers interchangeable scraper, bottom-dump, flat-bed, crane, logging arch.

Tournapull—Trademark Reg. U.S. Pat. Off. R-1171-G-b

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

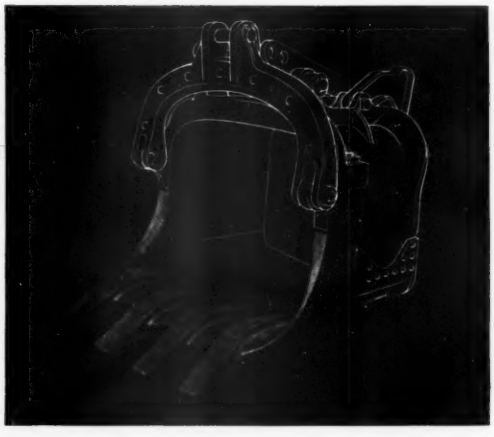
THIS AMSCO® LIP TAKES A SHARPER BITE

. . . chews out full loads at normal power

The lip juts way out where it easily bites up—and delivers—the full yardage of coal. It's a sharp *extension* of the dipper, with fanned teeth—for fast, easy penetration. The dipper digs out a heavier load without strain on the shovel . . . even requires less power, and prolongs life of all parts.

This Amsco lip lasts a long, long time, because it's made of the toughest steel known—manganese steel—the metal that work-hardens to fight off wear by impact and abrasion. Lip replacement is simple, when necessary, keeping downtime short.

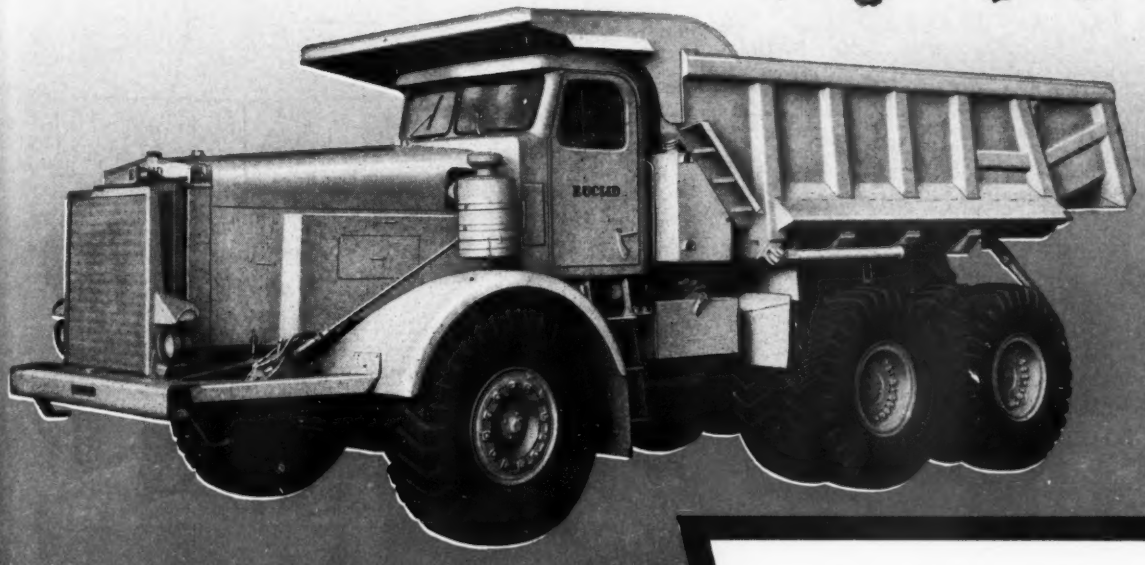
If getting more pay loads moved faster with less wear on equipment means more profits to you, *specify Amsco Renewable Lip Dippers.*



AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

Now MOVE 40 TON LOADS AT LOWEST COST WITH THIS Euclid R-40



TWIN-POWER REAR-DUMP

470 OR 500 TOTAL H.P.
TORQMATIC DRIVES
18.00 x 25 TIRES
80,000 LB. PAYLOAD
26 CU. YDS. STRUCK

This model R-40 is the newest addition to Euclid's complete line of Rear-Dump haulers. Built for jobs where big loads must be hauled, it incorporates all of the advance design features that have made "Eucs" the standard of performance for hauling heavy excavation in construction, mine, quarry and industrial service.

Two power trains—each with separate engine, 3-speed Torqmatic Drive and planetary drive axle—provide plenty of power to move capacity loads over tough haul roads and steep grades. The tandem axles are spring mounted to permit fast travel on good haul roads . . . the R-40 has a top speed of 26 mph with full payload.

Hydraulic booster steering makes this big Euclid easy to handle in close quarters and on tough hauls. Dumping angle of 67° and smooth interior of exhaust heated body assure quick, clean shedding of the load into hoppers, over the bank, or on the fill.

Your Euclid dealer will be glad to discuss the model R-40 and your off-highway hauling problems. He'll provide a production-cost estimate for present or planned operations, and can show you why ***Euclids are your best investment.***

EUCLID DIVISION, GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

Here's news for the knot hole gang!

No reason to peek and wonder any longer—

Lee-Norse NEW LOW COAL MINER
(LCM—26)

will be on DISPLAY in Booth No. 115-119 at the AMERICAN MINING CONGRESS in CLEVELAND—May 13-16! SEE IT!

SEE, too, the well-known and already widely used Lee-Norse Miner and the popular Mine Portal Bus!

Lee-Norse Company
CHARLEROI, PA.
"SPECIALISTS IN COAL MINING EQUIPMENT"

PERFO

ROOF BOLTING SYSTEM for AREAS WITH POOR ANCHORAGE

You can now have the advantages of roof bolting in areas where conventional bolts will not function. PERFO gives uniform anchorage along the entire length of the bolt. It is well suited for areas subject to high shear stresses, areas of softer rock and poor anchorage, and areas requiring high holding strengths.

See PERFO at Booth No. 2805 at the Coal Show in Cleveland.

Fill PERFO half-sleeves with soft, plastic mortar

Join half-sleeves and tie with wire

Insert PERFO sleeve

Drive reinforcing bar

SIKA Products for Mine Maintenance and Construction

Grouting—GROUT SIKA and PLASTIMENT

GROUT SIKA where water is encountered and pressure grouting with accelerated set is necessary to seal off the leakage. PLASTIMENT retards set of grout for penetration of deep fissures over long distances.

Air-Applied Mortar—SIGUNIT

For accelerated set, to make guniting easier and more effective in wet mining areas.

Sealing Leakage by Hand—SIKA NO. 2 and SIKA NO. 4-A QUICKSETS

SIKA NO. 2, for plugging high pressure leakage, will cause cement to set in 15 seconds. SIKA NO 4-A, for sealing moderate pressure leakage, will cause an initial set in 45 seconds.

High Quality Watertight Concrete – PLASTIMENT RETARDING DENSIFIER

In addition to retarding set of concrete for pumpcreting or transport over long distances, PLASTIMENT will reduce cracking and improve all structural properties.

High Early Strength Concrete—SIKACRETE ACCELERATING DENSIFIER.

Offers the same structural advantages as PLASTIMENT, plus an approved accelerator for high early strength.

Waterstop—IGAS JOINT SEALER

For watertight joints subject to movement and water pressure.

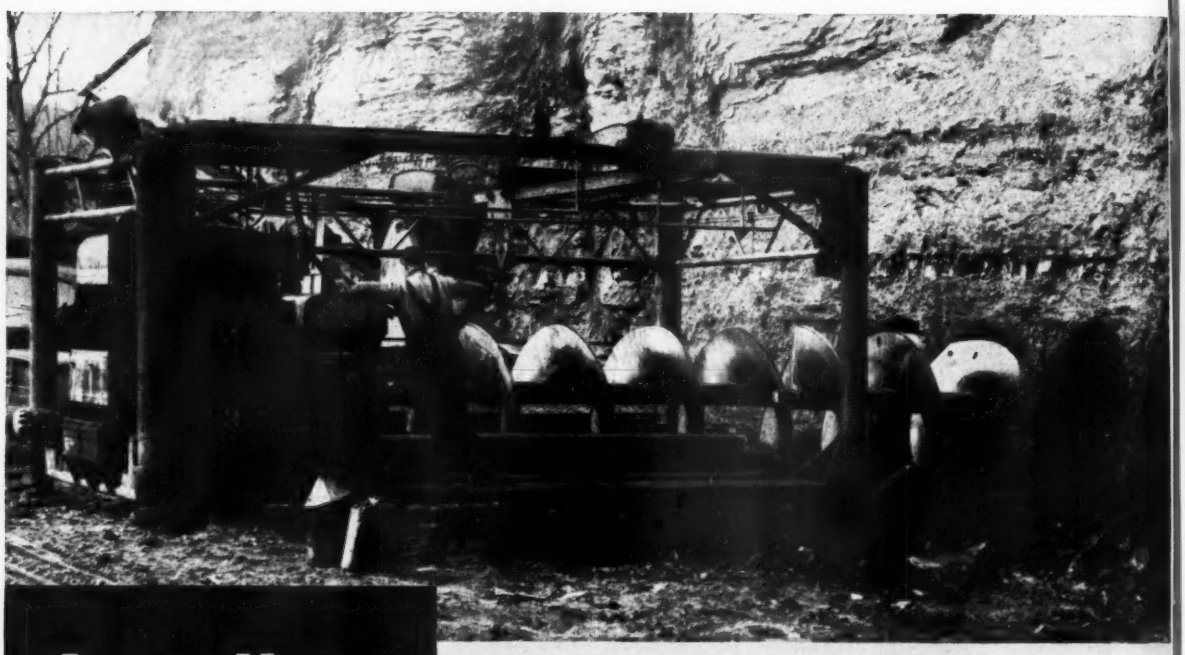
Sika®

SIKA CHEMICAL CORPORATION

PASSAIC, NEW JERSEY

FOR MORE PROFITABLE

CARDOX presents 5 practical answers to rising costs



CARDOX® AUGERMINER

MODEL 235

for lowest cost continuous SURFACE COAL MINING— UP TO 700 TONS A DAY

The most economical method for mining coal, on a per ton basis! Operating easily in any 26-foot pit, the Cardox AugerMiner, Model 235, drills under the overburden to bring out pure coal—from holes up to 50″ in diameter. With only a 3-man team, it can work almost continuously because it is *self-positioning* and *self-moving.* As the AugerMiner spans *two* holes, *augers are stored in the completed hole and recovered as needed for extension into the new hole to any practical length desired.* Providing the BIG power you need, the CARDOX Auger-Miner is an extremely rugged machine that needs minimum maintenance. Its simple design also makes maintenance easier.

SEE THE CARDOX AUGERMINER IN ACTION AT THE COAL CONVENTION

Demonstration at CARDOX Outdoor Booth #550, will simulate operation in continuous surface coal mining.

CARDOX

PRODUCTION!

costs . . . see them at the **COAL CONVENTION**

new improved

semi-portable

AIRDOX

compressor

The familiar AIRDOX Compressor is now available with either rubber-tired wheels or flange wheels for track use. Mounted on a heavy-duty frame with towing bar, this semi-portable unit can be readily moved from place to place within the mine. Components arranged "in-line" permit narrower width for easy mobility. SEE THIS IMPROVED MODEL FOR THE FIRST TIME AT THE CARDOX BOOTH AT THE COAL CONVENTION.

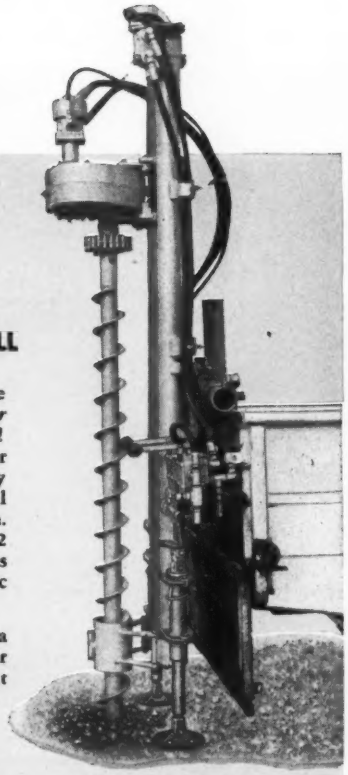
At the Coal Convention . . . see also the Standard AIRDOX Compressor on exhibit . . . the time-tested "workhorse" of non-explosive mining with a proven record of hundreds of millions of tons of coal produced economically.

new model

CARDOX

hydraulically powered

GENERAL PURPOSE DRILL



You'll probably agree, it's the most downright *usable* drill, *for more jobs*, than you've ever seen! Mounts on any truck, crawler or farm tractor . . . and drills at any angle from horizontal to vertical and in any lateral direction. Handles augers from 3 to 12 inches in diameter, at feed rates up to 20 fpm. All-hydraulic power and controls.

Dismounted, it doubles as a trench drill or can be used for horizontal drilling at different levels.

new **CARDOX**

horizontal hydraulic

HEAVY DUTY DRILL

A brand new, more powerful drill to speed up high wall or bank drilling of blast holes. Just roll it up to the job and drill. New water-cooled engine is amply powered to handle drills up to 8" in diameter. The new hydraulic coupling provides virtually shock-free transmission of power to the drill, saves wear and tear. Wide, rigidly reinforced frame insures stability in operation. Unit is also available in a self-propelled model.

remember

AT THE COAL CONVENTION
CARDOX WILL HAVE TWO SEPARATE EXHIBITS

INDOORS at Booths 2023 and 2122 where all equipment (except the AugerMiner) described here will be on display.

OUTDOORS at Booth 550, where the CARDOX AugerMiner, Model 235, will be in operation, simulating continuous surface coal mining.

AT BOTH BOOTHS the CARDOX exhibit staff will be on hand to answer all your questions. Make it a date to visit us!

CARDOX CORPORATION • **307 North Michigan, Avenue** • **Chicago 1, Illinois**

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Harper, West Virginia
Phone: Beckley—Clifford 3-4812

Benton, Illinois—Box 537
Phone: Benton 8-3821

St. Clairsville, Ohio—Box #1
Phone: St. Clairsville 619

Pikeville, Kentucky
Route 2, Box 571
Phone: Robinson Creek 5

Louisville, Colorado
Phone: Boulder
Hillcrest 2-7298

Library, Pennsylvania
Box 427
Phone: Tennyson 5-6910

Camden-on-Gauley, W. Va.
Phone:
Camden-on-Gauley 2181

Evansville, Indiana, Box 84
307 Northwest Fifth St.
Phone: Harrison 2-8944

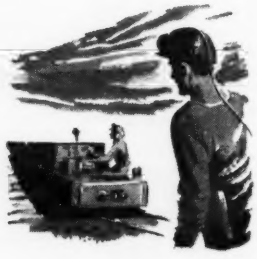
Ottumwa, Iowa
Phone: Ottumwa
Murray 4-6564

The world of science behind
EXIDE-IRONCLAD BATTERIES

Being interviewed is W. W. Smith, Divisional Manager, Product Engineering. Grids in back are of Exide's exclusive Silvium. Those in front are ordinary alloys.

"All of these alloys had the same acid test"

At the Exide Laboratories—**Reporter:** Was it a typical charge-discharge test normally used to test battery components?



Smith: Right. And the two positive plate grids with no visible signs of corrosion are Exide's patented Silvium alloy.

Reporter: How about the others—what alloys are they?

Smith: They're standard alloys used in other well-known makes of batteries. But they don't have Silvium's corrosion-resisting ingredients.

Reporter: Where is Silvium used?

Smith: In the positive plates of all Exide-Ironclad and many other Exide Batteries.

Reporter: How does it affect battery performance?

Smith: Every test we've made proves it stretches battery life because the grid resists corrosion—sometimes up to 100% longer.

Reporter: Obviously this is an important feature of the Exide-Ironclad.

Smith: Yes it is, but it's just one of many engineering details that contribute to its high capacity and long life.

Note to battery users: Whenever you order heavy duty batteries or the equipment that requires them, be sure to specify Exide-Ironclad. For detailed bulletin, write Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide®**

A Southern Ohio stripper cut over-all mining costs 25 cents per ton by augering low-cost recovery coal with this McCarthy Coal Recovery Drill. The recovery coal itself cost $1.25 less per ton than the strip coal.

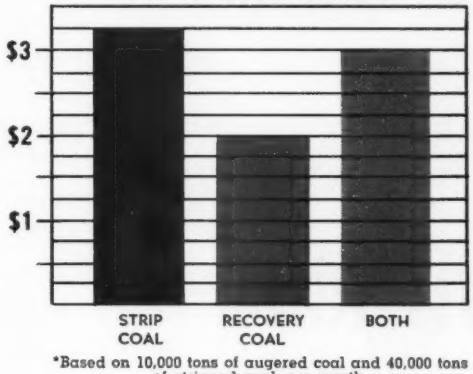
AUGERED and STRIP COAL COMBINED CUTS STRIPPER'S COST 25 cents per ton

Auger-mine low-cost recovery coal to lower your stripping costs—as much as 25 cents a ton!

One Southern Ohio strip mine operator saved this much with only one McCarthy Model 14-30-36 Coal Recovery Drill. Working one six-hour shift per day with only two operators, he augered approximately 10,000 tons per month of recovery coal. The cost per ton, including make-ready, operation, maintenance, depreciation and hauling, was only $2. By spreading this saving over his entire operation, he cut his delivered strip coal cost from $3.25 to $3 per ton. Strip coal output was about 40,000 tons per month.

This is why more strippers each year add McCarthy Coal Recovery Drills to their list of production equipment. The McCarthy drill is a cost-saver and a money-maker. It's self-moving, all hydraulic, and requires only two operators. Contact the nearest Salem Tool representative for details. For immediate service, phone or write direct.

It Pays to Auger-Mine Low-Cost Recovery Coal



*Based on 10,000 tons of augered coal and 40,000 tons of stripped coal per month.

Manufacturer of Drilling Equipment Since 1901

THE SALEM TOOL CO.

779 S. ELLSWORTH AVE. · SALEM, OHIO U. S. A.

IMPOSSIBLE WITHOUT EXPLOSIVES

To break down coal seams interspersed with thick bands of heavy rock and slate, a strong, dense grade of permissible powder is needed to get economical results from blasts.

Hercules manufactures such a permissible powder, along with other grades and strengths of explosives to meet the many and varied conditions in coal mines throughout the nation.

Our technical sales-service representatives welcome the opportunity to discuss with you Hercules permissible powders in "King-Size" cartridges, and to show how their use results in improved methods of blasting and more efficient operation of your coal mine.

XR57-3

HERCULES POWDER COMPANY
INCORPORATED

Explosives Department, 936 King St., Wilmington, Del.

Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Calif.; New York, N. Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Calif.

HERCULES

BOOTH 1813

1957 AMC COAL SHOW

CLEVELAND, OHIO
MAY 13-16

My name is J. H. Sanford, Manager of the Mining Division of the Ohio Brass Company.

I'd like to invite you to visit us at the O-B booth, where you'll find some of the most striking exhibits, some of the most interesting new product developments you've ever seen, including:

- A new O-B color film on roof bolting safety *(available through your O-B representative)*
- A new O-B Roof Support Expansion Unit
- A new O-B 3,000-amp Feeder Safety Switch
- A new O-B Cable Fault Locator
- A new O-B Mine Locomotive Current Collector
- A new O-B Hanger Installation Tester

I suggest you make sure that Booth 1813 (the same booth we've occupied in past years) is high on your list of "must see's" when you come to Cleveland May 13-16!

See your April Haulage Ways for a full preview of these new O-B developments!

Ohio Brass

MANSFIELD OHIO • U.S.A.

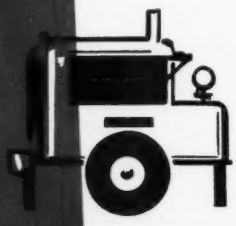
IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4899-M

Got a tough job?

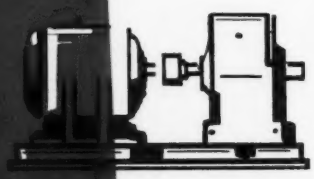
Give it to STANOIL Industrial Oil

This oil gives superior lubrication to a long list of mine equipment—here are three big jobs it can do—



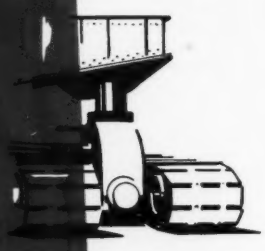
COMPRESSOR

High oxidation stability and low carbon-forming characteristics of STANOIL virtually eliminate the danger of carbon deposits on valves. STANOIL separates readily from water. There is no problem of emulsion in compressor crankcase.



SPEED REDUCER

There are many years between maintenance jobs on speed reducers when STANOIL is the lubricant. Herringbone gears remain clean and free of wear. Low pour point of STANOIL gives oil ability to flow freely from a cold start. No trouble either in prolonged, high temperature operation.



HYDRAULIC JACKS

Tough mine hydraulic service is the ideal place for STANOIL. High viscosity index and low pour point of STANOIL assure smooth operation no matter what the temperature. STANOIL resists contamination, will not emulsify.

Pick your tough lubrication jobs, give them to STANOIL Industrial Oil and get the results you have wanted. Find out more. Call your Standard Oil industrial lubrication specialist. There is one near you in any of the 15 Midwest and Rocky Mountain states. He is experienced in mine lubrication. Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

Quick Facts About

STANOIL Industrial Oil

- **Stability**—STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.
- **Rust Prevention**—Inhibitor in STANOIL "plates out" on metal surfaces, prevents corrosion.
- **Cold Starts**—STANOIL has low pour point. Flows freely from cold start. No need for costly warm-ups.
- **Resists Effects of Temperature Change**—STANOIL has high viscosity index, is resistant to temperature change.
- **Has Excellent Demulsibility**—STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.

STANDARD OIL COMPANY
(Indiana)

STANDARD

NEW

MACK

heavy-duty four- and six-wheel dumpers

15- to 34-ton capacity

* LARGEST SELECTION OF HEAVY DUMPERS

Mack offers you the most complete line of dumpers for mining, quarrying, road building, construction. From heavy-duty 170 horsepower, four-wheel dumpers with 15-ton capacities to super-duty 400-horsepower, six-wheel dumpers with 34-ton capacities, Mack provides the economy and performance that can mean bigger hauling profits for you.

* CHOICE OF ENGINES

Mack offers you a choice of engines... Cummins diesels in the 300- and 400-horsepower class... or Mack Thermodyne and Cummins diesels in the 170 to 205 horsepower class. No need to alter existing maintenance facilities to handle new engine makes... you get the truck you want with the engine you want.

* OUTSTANDING PERFORMANCE

When you buy Macks, you know that you are getting top performance, outstanding economy, maximum dependability—qualities that have made Mack the acknowledged heavy-duty truck leader in the industry. Moreover, Mack dumpers are planned for accessibility throughout... engines are easily reached, no place in the suspension ever needs adjustment—these and many more Mack features reduce maintenance costs and make routine servicing easier. And in Macks, you get the finest transmissions and axles available... made by Mack and found only in Macks!

* COMPETITIVELY PRICED

Mack off-highway dumpers are priced right in line with competitive makes. Yet, with Macks, you get these "extras" that mean more payloads at lower hauling costs... cabs engineered for maximum driver efficiency... specially designed components with extensive use of heat-treated alloy steels... single-unit all-welded frames that can take plenty of hard knocks... outstanding performance and economy from a complete line of engines.

* STOCK DELIVERY

All 15 and 22½-ton Mack dumpers are available from stock. The units you want with the engines and transmissions you want can be supplied upon gratifyingly short notice. There are no delays, no production schedules for you to worry about. For more information on delivery, contact your local Mack Dealer or Representative.

ARD

MACK LRX

capacity: 15 tons

This four-wheel, off-highway dumper combines a big 15-ton rated capacity with outstanding maneuverability. Either a Mack or Cummins diesel engine of the 200-horsepower class—along with heavy-duty clutch, 10-speed transmission, and Mack's Planidrive rear axle assembly—gives plenty of pulling power for long hauls on steep grades. Rugged, unified frame assembly, powerful air brakes, and comfortable cab with driver's position offset to the left assure the top performance and efficiency that have made the LRX a highly popular dumper in mine, quarry, and road-building operations.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:	14.00-24 Rear Tire
Wheel Base	12′ 6″
Platform	9′ 1″
Overall Width	10′ 9½″
Overall Height	10′ 5″
Overall Height (Body Raised)	18′ 8″
Overall Length	24′ 7½″
Turning Circle Diam. (To outside edge of tire)	60′
Weight (Chassis, Body & Hoist)	33,000 lbs.
Payload	30,000 lbs.

ENGINE (Diesel):

Model	END 673
Make	Mack, Thermodyne
Type	Naturally aspirated
Number of cylinders	Six
Bore and stroke	4⅞″ x 6″
Piston displacement, cu. in.	672
Brake horsepower @ 2100 r.p.m. (gov.)	170
Max. torque @ 1200 r.p.m.	480 lb.-ft.

CLUTCH (Available with END 673 only):

Type	Mack single-plate, dry
Area of engagement, sq. in.	253

ELECTRICAL SYSTEM:

Voltage and capacity . 12 V., 50 Amp. (24 V., Starting)

TRANSMISSION:

Type	Mack selective, constant mesh
No. of speeds, forward	Nine
reverse	Two

FRONT AXLE:

Make . Mack Reversed-Elliott, dropped forged I-beam

REAR AXLE:

Make	Mack Planidrive
Drive	Dual Reduction
Final Drive (3rd reduction)	Planetary gear train within wheel hubs
Total Ratio	16.5

BRAKES (Air):

Compressor	Tu-Flo
Type	Internal expanding
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	12″ x 5″ x ⅜″, Bendix

FRAME:

Side-members, size	12½″ x 6¾″ x ½″, wide flange I-beam, rolled section
Section modulus	60.7 (per rail)

SPRINGS:

Front, type	Semi-elliptic
Rear, suspension	Semi-rigid, axle saddle mounted to frame

WHEELS:

Type . . . . . Cast, spoke

STEERING GEAR:

Control . . . . . Manual

TIRES:	Front	Rear
Size	12.00-24 (16P) Rib	14.00-24 (20P) Lug

CAB:

Type: Heavy-duty off-highway, closed, all-steel welded. Offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Front and rear tow pins; air horn on cab roof; cab entrance steps and platforms; rear view mirror, left side; channel type front bumper; dual windshield wipers; stop-tail light; rim lug wrench and handle.

HOIST:

Make & model . . . . . Heil
Type-Twin, double-acting, 8″ diameter, hydraulic cylinders with 24″ stroke, 70° dumping angle.

BODY:

Type	Rock, with scoop end
Make	Heil
Capacity, line of plate	9.8 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 5 lb. channels between floor plates either side of a 1⅝″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE (Diesel):

Model	NHB	ENDT 673
Make	Cummins	Mack, Thermodyne
Type	Naturally aspirated	Turbocharged
Number of cylinders	Six	Six
Bore and stroke	5⅛″ x 6″	4⅞″ x 6″
Piston displacement cu. in.	743	672
Brake horsepower @ 2100 r.p.m. (gov.)	200	205
Max. torque @ r.p.m.	1200	1400-1600
pound-feet	537	560

CLUTCH (Included with NHB and ENDT 673):

Type	Mack two-plate, dry
Area of engagement, sq. in.	416

TIRES:	Front	Rear
Size	13.00-24 (18P) Rib	16.00-25 (20P) Lug

BODY:

Type	Flared Quarry
Make	Heil
Capacity, line of plate	11 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ½″ sides; ⅜″ header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 5 lb. channels between floor plates either side of a 1⅝″ edge-grain hardwood middle section filler.

Exhaust Heating: Provisions for exhaust heating of dump body available.

Body Equipment: (for std. and opt. bodies): (9) ¾″ x 6″ alloy wear bars; rock ejectors; ½″ alloy wear plate; welded-on side boards (for std. body only).

CHASSIS EQUIPMENT: Automatic radiator shutters; Wagner "BB" (24 hour chart 0-3500 r.p.m.) tachograph, in place of standard tachometer; speedometer; hubodometer, left front wheel; Vickers power steering; front wheel limiting valve; hand control valve to operate rear service brakes; low air pressure indicator, Wig-Wag type; radiator guard; 25,000 B.T.U. hot water cab heater with defrosters; spare rim; hydraulic jack, 20-ton; air starting.

MACK LRSW

capacity: 30 tons

Powered by a 300-horsepower engine, this 30-ton, six-wheel dumper has what it takes for off-highway operation in mines, quarries and earth-moving projects. Smooth application of power to its balanced, four-wheel drive bogie is obtained by an air-assisted clutch and overgear transmission with two-speed compound or torque converter. Convenient location of controls, angle steering column, hydraulic steering booster, and extreme left driver position give easy and efficient handling. Best materials, precision manufacture, and specially engineered components make the LRSW capable of withstanding the toughest 'round-the-clock hauling.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	16′ 10″
Platform	14′ 11½″
Overall Width	11′ 1⅝″
Overall Height	11′ 5⅜″
Overall Length	29′ 4″
Overall Height (Body Raised)	24′ 10″
Turning Circle Diam. (To outside edge of tire)	78′
Weight (chassis, body & hoist)	60,000 lbs.
Payload	60,000 lbs.

ENGINE (Diesel):

Model	NHRBIS
Make	Cummins
Type	Supercharged
Number of cylinders	6
Bore and stroke	5⅛″ x 6″
Piston displacement, cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	300
Max. torque @ 1500 r.p.m.	818 lb.-ft.

CLUTCH:

Type	Mack two-plate, dry
Area of engagement, sq. in.	416
Actuation	Manual, with air assist

ELECTRICAL SYSTEM:

Voltage and capacity	12 V., 50 Amp. with 24 V., starting

TRANSMISSION:

Type	Mack two-lever, Duplex
No. of speeds, forward	Eight
reverse	Two

FRONT AXLE:
Type . . . . Mack Reversed-Elliott, drop forged I-beam

BOGIE:

Make	Mack Planidrive
Final drive, type	Four-wheel, planetary
Inter-axle differential, type	Mack concentric cam and plunger Power Divider
Carriers	Mack Dual Reduction
Total Ratio	18.18

BRAKES:

Type and actuation	Internal expanding, inclosed, air
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	16″ x 3″ x ¼″, four-shoe, disc

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	13 15/16″ x 8″ with ⅝″ web and top flange, ⅞″ bottom flange
Section modulus	84.5 per rail

SPRINGS:

Type, front	Semi-elliptic
rear	Semi-elliptic, inverted
Suspension, Mack	Rubber Shock Insulators

SHOCK ABSORBERS, FRONT:
Type . . . . Houdaille, hydraulic

TIRES (Lug):	Front	Rear
Size	14.00-24 (20P)	16.00-25 (20P)

WHEELS . . . . Cast, spoke

STEERING GEAR:
Power steering assist . . . Vickers hydraulic booster

CAB:
Type . . Heavy-duty off-highway, closed, all-steel, welded. Offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Hubodometer; screen type radiator guard; front and rear tow pins; air horn; rear view mirror, left side; exhaust through hood with in-line muffler; channel type front bumper; door in hood side for access to oil filler and dip stick; insulating dash mat; wig-wag low air pressure indicator; windshield wipers; stop and tail light; back up light; rim lug wrench and handle.

HOIST:
Make . . . . Heil
Type—Twin, double-acting, 10″ diameter, hydraulic cylinders with 40″ stroke, 70° dumping angle with power return.

BODY:

Make and type	Heil, Rock-scoop end
Capacity, line of plate	21 cu. yds.

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE:

Make and model	Cummins, NRTO
Number of cylinders	Six
Bore and stroke	5⅛″ x 6″
Piston Displacement cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	335
Max. torque @ 1500 r.p.m.	900 lb.-ft.
Turbocharger	Turbine, exhaust driven

TRANSMISSIONS:
Westinghouse Converter and Mack 4-Speed Transmission. Clutch—2-plate, 17″.
Allison Torqmatic Converter and Allison Transmission

WHEELS, TIRES:

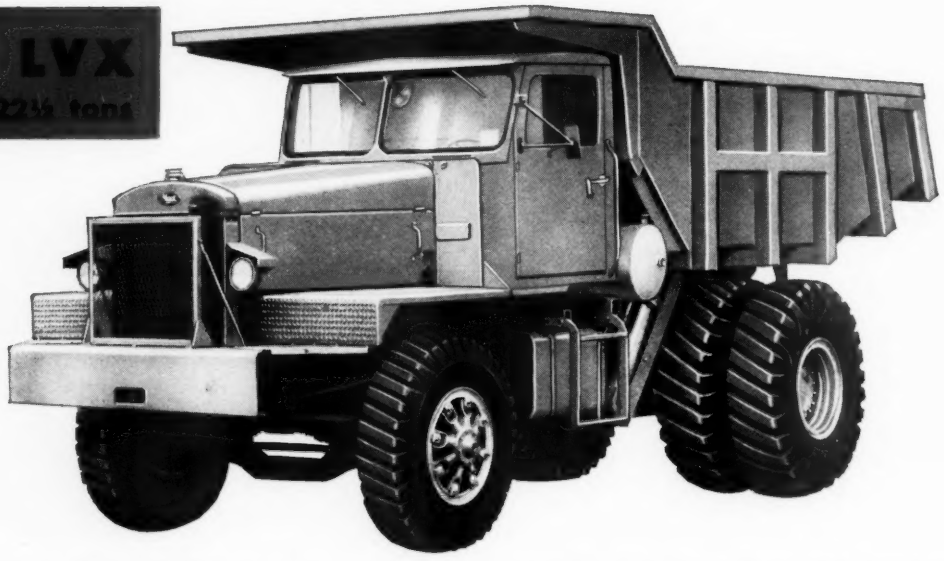
Front & rear Wheels, type	Cast spoke
Tires, size	16.00-25
Ply-rating, front	20 or 24
rear	24

BODY EXHAUST HEATING: Provisions to permit passage of exhaust gases through area between wear plate and shell bottom; controlled by baffles and exhausted through second rear vertical bolster on right side.

CHASSIS EQUIPMENT: Front wheel brake limiting valve; separator for air system; 25,000 B.T.U. heater with defrosters; windshield defroster fan; engine chrome cylinder liners and stellite inlet valve seats; tachograph, Wagner "BB", 24-hour chart 0-3500 r.p.m. (in place of standard tachometer); speedometer (single-hand); exhaust outlet under cab suitable for attachment to body for body heating; automatic (air) radiator shutters; 20-ton jack, hydraulic; spare rim.

MACK LVX

capacity: 22½ tons



This four-wheel dumper with its 22½-ton rated capacity provides maximum payloads at minimum unit cost. Equipped with a 300-horsepower engine, over-gear transmission with two-speed compound or torque converter, and Mack's exclusive Planidrive rear axle assembly, it is powered to give top performance under the most punishing operating conditions.

All-welded, single-unit, alloy-steel frame gives LVX's stamina and rugged durability. Elbow steering column, hydraulic steering booster, two-plate air-assisted clutch, and job-engineered cab with extreme left driver position assure maximum operating efficiency. From top to bottom, this big Mack gives you the "extras" that mean minimum hauling costs.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	14′ 2″
Platform	9′ 11″
Overall Width	11′ 2″
Overall Height	11′ 6¼″
Overall Length	26′ 8½″
Overall Height (Body Raised)	21′
Turning Circle Diam. (To outside edge of tire)	62′
Weight (chassis, body & hoist)	40,800 lbs.
Payload	45,000 lbs.

ENGINE (Diesel):

Model	NHRBIS
Make	Cummins
Type	Supercharged
Number of cylinders	Six
Bore and stroke	5⅛″ x 6″
Piston displacement, cu. in.	743
Brake horsepower (@ 2100 r.p.m. (gov.)	300
Max. torque@ 1500 r.p.m.	818 lb.-ft.

CLUTCH:

Type	Mack Two-plate, dry
Area of engagement, sq. in.	416
Actuation	Manual, with air assist

ELECTRICAL SYSTEM:
Voltage and capacity . 12 V., 50 Amp. (24 V. Starting)

TRANSMISSION:

Type	Mack selective, constant mesh
No. of speeds, forward	Eight
reverse	Two

FRONT AXLE:
Type . . . Mack Reversed-Elliott, drop forged I-beam

REAR AXLE:

Make	Mack Planidrive
Drive	Dual reduction, spiral bevel
Final drive (3rd reduction)	Planetary gear train within wheel hubs
Total Ratio	17.66

BRAKES (Air):

Compressor	Tu-Flo
Type	Internal expanding
Front, size	17¼″ x 5″ x ¾″
Rear, size	18″ x 10″ x ¾″
Hand, size	16″ x 3″ x ¼″

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	13 11/16″ x 8″ x ⅝″ (Fabricated)
Section modulus	74.8 per rail

SPRINGS:

Front	
Type	Semi-elliptic
Suspension	Mack rubber shock insulators
Rear	
Type	Progressive rate, semi-elliptic
Suspension	Cam face slipper ends with radius rods

TIRES:	Front	Rear
Size	14.00-24 (16P) Rib	18.00-25 (24P) Lug

WHEELS:
Type . . . Cast, spoke

STEERING GEAR:
Power steering assist . . . Vickers hydraulic booster

CAB:
Type . Heavy-duty off-highway, closed, all-steel, welded. Cab offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Screen type radiator guard; front and rear tow pins; air horn on cab roof; dual windshield wipers; two air reservoirs; rear view mirror, left side; exhaust through hood with inline muffler; channel type front bumper; stop-tail light; rim lug wrench and handle.

HOIST:
Type . . . Twin, double-acting, outboard mounted, three section telescopic cylinder assembly directly connected to body and chassis through a universal joint arrangement providing a 70° dumping angle.

BODY:

Type	Rock, with scoop end
Make	Heil
Capacity, line of plate	14.8 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE:

Model	NRTO
Make & type	Cummins, turbocharged
Number of cylinders	Six
Bore and stroke	5⅛″ x 6″
Piston displacement, cu. in.	743
Brake H.P.(@ 2100 r.p.m. (gov.)	335
Max. torque@ 1500 r.p.m.	900 lb.-ft.

TRANSMISSIONS:
Westinghouse Converter and Mack 4-Speed Transmission. Clutch—2-plate, 17″.
Allison Torqmatic Converter and Allison Transmission.

FRONT AXLE: Special Heavy-duty, Reversed-Elliott, Drop Forged I-beam.

TIRES:	Front
Size	14.00-24 (20P) Rib

BODY:

Type	Flared Quarry
Make	Heil
Capacity, line of plate	15 cu. yds., struck

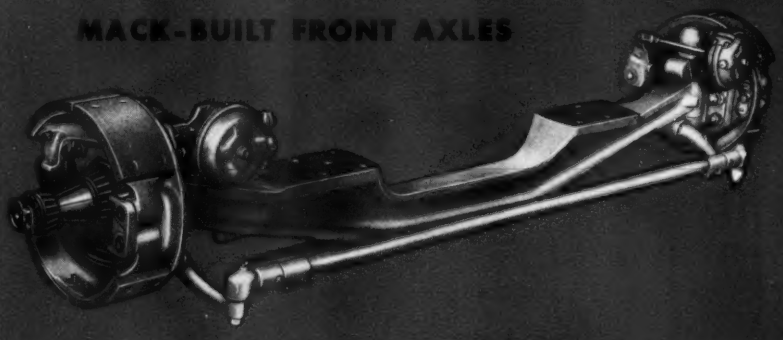
Construction: ¼″ steel plate shell bottom; ½″ sides; ⅜″ header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

Exhaust Heating: Provision for exhaust heating of dump body available.

CHASSIS EQUIPMENT: Air starting, Ingersoll-Rand 9HP; Tachograph, Wagner "BB" (24 hour chart 0-3500 r.p.m.) in place of standard tachometer; Wig-Wag low air pressure indicator; hand control valve to operate rear service brakes; front wheel brake limiting valve; 25,000 B.T.U. hot water cab heater with defrosters; windshield fan mounted on windshield header; hub-odometer; air operated radiator shutter; Schwitzer air operated Thermo-controlled radiator fan hub; speedometer; back-up light; hydraulic jack, 20-ton; spare rims.

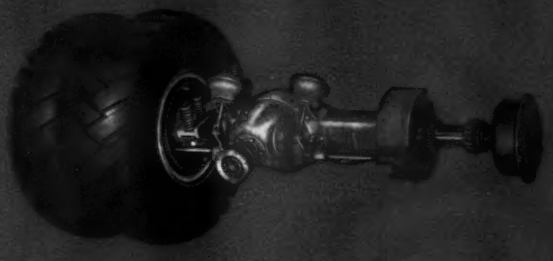
only MACK gives you features like these...

MACK-BUILT FRONT AXLES



Mack's reversed Elliott, forged I-beam front axles are made extra strong for long, trouble-free service. Extensive use of heat-treated steels for crucial parts means minimum maintenance. Straight tie rod and rugged construction of air-actuated brake shoes insure top performance.

MACK-BUILT 2-WHEEL REAR AXLES

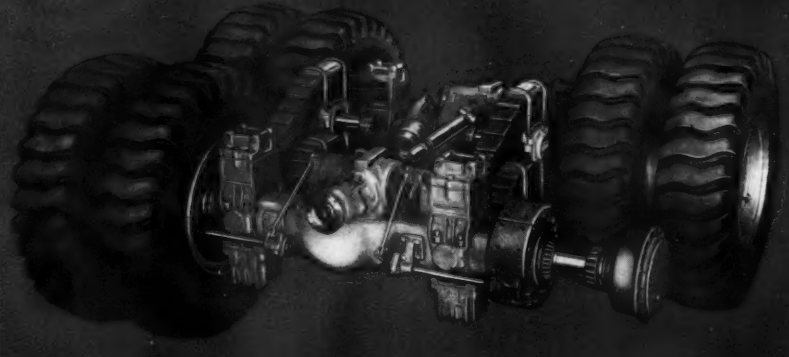


Mack's two-wheel, rear axle assemblies have an unmatched reputation for durability under strenuous service. The strongest, most wear-resistant materials are used throughout. Dual reduction, gear-type differential and Mack's famous planetary gear reduction at the wheel hubs (Planidrive) provide the smooth distribution of power needed for top truck performance. Planetary gears can be serviced or repaired without removing tires or disturbing wheel bearing adjustment.

MACK-BUILT TRANSMISSIONS

Dependable performance and long life are standard in Mack transmissions. Shown here is the heavy-duty overgear transmission used for the LRVSW, LRSW, and LVX off-highway dumpers. The four-speed main transmission and two-speed compound are assembled as a unit to give eight forward and two reverse speeds. The four-speed main transmission without the two-speed compound is offered in combination with torque converter. All gears use Mack tetrapoid or quadrapoid tooth design and are drop-forged, case-hardened, and generator-ground . . . gears noted for lasting the life of the truck.

MACK-BUILT 4-WHEEL BALANCED BOGIES WITH EXCLUSIVE POWER DIVIDER



Under the worst conditions of mud, loose gravel, or difficult terrain, you get maximum pulling power with Mack's four-wheel drive Balanced Bogies because exclusive Mack Power Dividers apply power to the wheels with traction. Planidrive final reduction gears in all four hubs provide needed reduction without excessively large carriers, differentials, or axle shafts. Maintenance is reduced to a minimum.

MACK LRVSW

capacity: 34 tons

The 34-ton rated capacity of this super-payload, six-wheel dumper assures minimum haulage costs for the big earth-moving jobs. Equipped with a 400-horsepower engine, four-speed overgear transmission, hydraulic torque converter or two-speed compound, and a balanced, four-wheel drive bogie, LRVSW's can negotiate severe grades fully loaded. Maneuverability and ease of handling are facilitated by such features as a hydraulic steering booster and air-assisted clutch. Heat-treated, stress-proportioned, single-unit frame gives the structural stamina needed to withstand severest operating conditions. All these features, and many more, contribute to unmatched durability and minimum haulage costs.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	16′ 10″
Platform	14′ 11½″
Overall Width	11′ 1⅝″
Overall Height	11′ 11″
Overall Length	31′ 7″
Overall Height (Body Raised)	25′ 2″
Turning Circle Diameter (To outside edge of tire)	78′
Weight (chassis, body & hoist)	68,000 lbs.
Payload	68,000 lbs.

ENGINE (Diesel):

Model	NVH-1200
Make	Cummins
Type	Naturally aspirated
Number of cylinders	12
Bore and stroke	5⅛″ x 6″
Piston displacement, cu. in.	1486
Brake horsepower @ 2100 r.p.m. (gov.)	400
Max. torque @ 1200 r.p.m.	1,075 lb.-ft.
Fuel tank and location	150 gal., back of cab

CLUTCH:

Make	Lipe Rollway
Type	Two-plate, dry
Area of engagement, sq. in.	571
Actuation	Manual, air assist

ELECTRICAL SYSTEM:

Voltage and capacity	12 V., 75 Amp.
Generator, make and type	Leece-Neville, alternator

STARTING SYSTEM:

Starting motor, type	Air
Make	Bendix-Westinghouse
Rating, horsepower	25
Cold starting aid	Ether injection

TRANSMISSION:

Type	Mack selective constant mesh
No. of speeds, forward	Four
reverse	One

TORQUE CONVERTER:

Model	Westinghouse 18″
Type	Single stage, hydraulic

FRONT AXLE:

Type . . . . Mack Reversed-Elliott, I-beam drop forged

BOGIE:

Make	Mack Planidrive
Final drive, type	Four wheel, planetary
Inter-axle Differential	Mack concentric cam and plunger type Power Divider
Carriers	Mack dual reduction
Total ratio	18.18

BRAKES:

Type and actuation	Internal expanding, inclosed, air
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	16″ x 3″ x ¼″, four-shoe, disc

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	Depth 14¼″, flange width 8″, flange thickness 1″
Section modulus	130.0 per side

SPRINGS:

Type	Semi-elliptic
Suspension, Mack	Rubber Shock Insulators

SHOCK ABSORBERS, FRONT:

Type . . . . Houdaille, hydraulic

TIRES (Lug) Front and Rear:

Size 16.00-25 (20P)

WHEELS:

Type . . . . Cast, spoke

STEERING GEAR:

Type	Worm and roller
Power steering assist	Vickers hydraulic booster

CAB:

Type . . Heavy-duty off-highway, closed, all-steel, welded. Offset 10¾″ to left of chassis center-line provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Screen type radiator guard; hubodometer; front and rear tow pins; air horn; rear view mirror, left side; dual exhaust through hood with inline mufflers; channel type front bumper; rim lug wrench and handle; door in hood side for access to oil filler and dip stick; insulating dash mat; windshield wipers; stop and tail light; back up light.

HOIST:

Make & Type . . Heil, twin, double-acting, outboard mounted, four-section telescopic cylinder assembly directly connected to body and chassis through a universal joint arrangement to provide maximum flexibility.

Dumping angle . 70°

BODY:

Make & Type	Heil Rock, scoop end
Capacity, line of plate	24 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

TRANSMISSION (In place of 4-Speed and Westinghouse Converter):

Make & Type	Mack Two-Lever, Duplex
Speeds Forward	8
Speeds Reverse	2

TIRES (Lug) Front and Rear:

Size 16.00-25 (24P)

BODY EXHAUST HEATING: Provisions to permit passage of exhaust gases through area between wear plate and shell bottom; controlled by baffles and exhausted through second rear vertical bolster on right side.

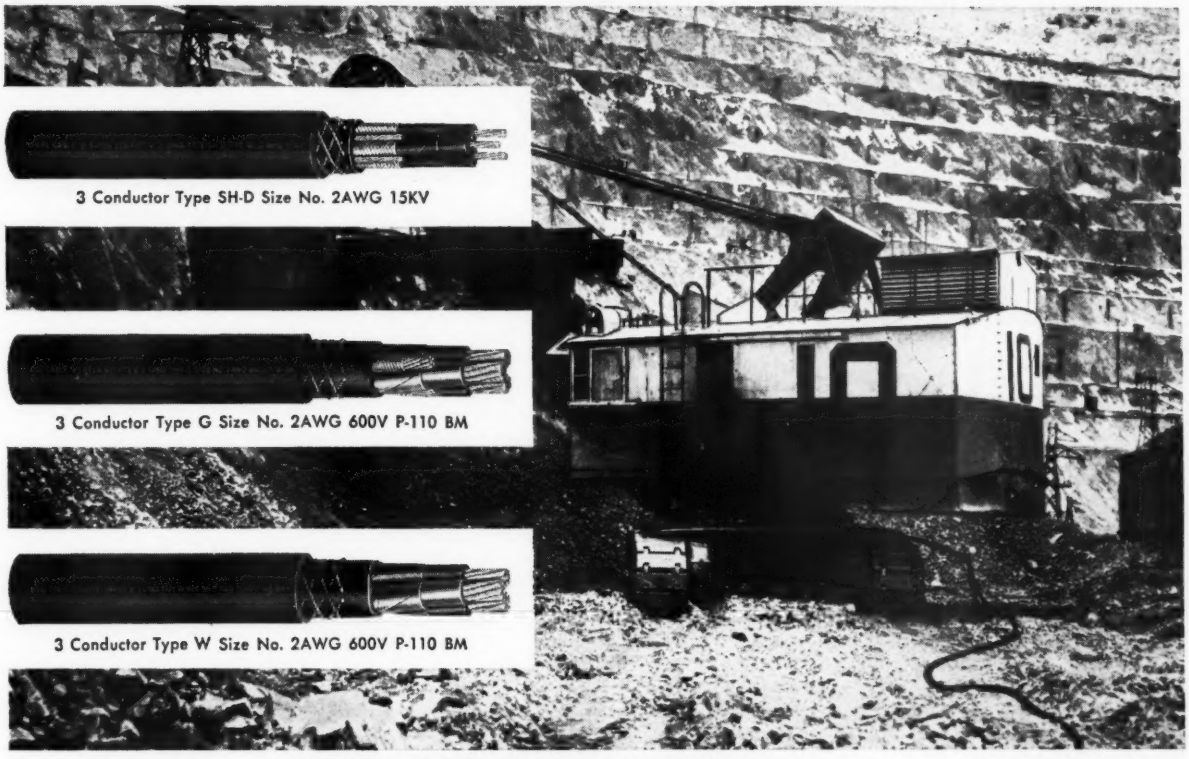
CHASSIS EQUIPMENT: Front wheel brake limiting valve; 25,000 B.T.U. heater with defrosters; windshield fan; speedometer (single-hand); tachograph, Wagner "BB"—24-hour chart, 0-3500 r.p.m. (in place of standard tachometer); engine fan—Schwitzer-Cummins fan drive with automatic temperature control; exhaust outlet under cab suitable for attachment to body for body heating; 20-ton hydraulic jack; spare rim.

MACK first name for TRUCKS

Mack Trucks, Inc., Plainfield, New Jersey • In Canada: Mack Trucks of Canada, Ltd.

GENERAL CABLE SUPER SERVICE

PORTABLE POWER and MINING CABLE


3 Conductor Type SH-D Size No. 2AWG 15KV
3 Conductor Type G Size No. 2AWG 600V P-110 BM
3 Conductor Type W Size No. 2AWG 600V P-110 BM

with SUPERTUF Jacket

GENERAL CABLE offers a complete line of SUPER SERVICE portable power and mining cables which will stand up under the most severe operating conditions and furnish longer life and reliable service no matter how difficult the application.

All SUPER SERVICE cables are jacketed with an extra heavy duty, vulcanized in mold, double layer cord reinforced "SUPERTUF" neoprene sheath with maximum resistance to tearing, cutting, abrasion and overall mechanical abuse, and possessing outstanding resistance to water, oil, acids, alkalis, flame and effects of sunlight and weathering.

SUPERTUF neoprene jacket far exceeds the requirements of ASTM D-752, and all 600 volt SUPER SERVICE portable cables bear the official approval number P-110 BM embossed in the jacket indicating compliance with the flame resistance requirements of the Pennsylvania Department of Mines and requirements of the Federal Bureau of Mines.

GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, New York
Offices and Distribution Centers Coast-to-Coast

for quality and service . . . **specify GENERAL CABLE**

The finest, fastest, most efficient coal dryers

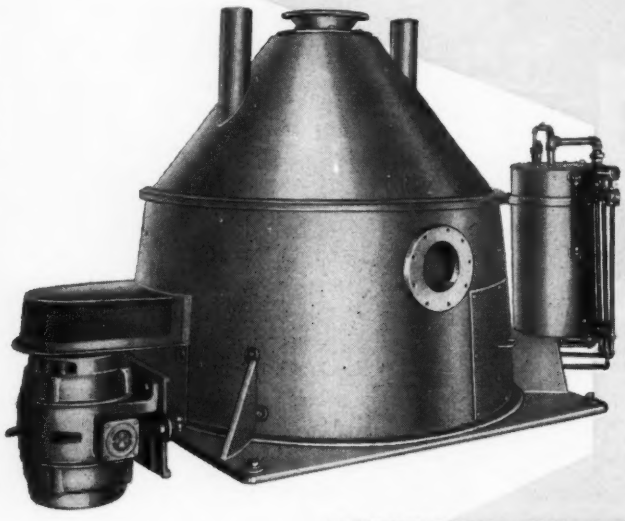
are still made by **C·M·I**

C·M·I

...a name worth repeating!

C·M·I

CONTINUOUS CENTRIFUGAL COAL DRYERS

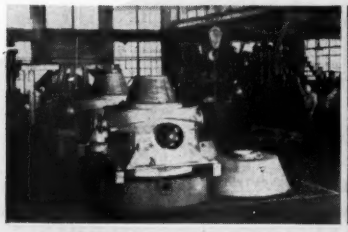


A FINE DRYER...PLUS SERVICE

The C.M.I. Dryer will do a magnificent job, reducing 35% moisture content in coal to less than 5%.
A whale for work; amazing drying capacity.
Our engineers are available to render prompt service whenever and wherever needed.

A FINE DRYER...PLUS SERVICE

The C.M.I. Dryer will also prove its worth as a real profit-producer by recovering marketable coal from your slurry ponds.
Our engineers are available to render prompt service whenever and wherever needed.



This is a 100% Home (U.S.A.) Industry.
All replacement parts are always available on short notice.
When in St. Louis, visit our factory.

C·M·I *Centrifugal* DRYERS

CENTRIFUGAL & MECHANICAL INDUSTRIES, INC.

146 PRESIDENT STREET • SAINT LOUIS 18, MISSOURI

inside story of a longer grind

Moly-Cop is hard and tough to the core...

A look inside this Moly-Cop ball shows a uniform, fine grain structure extending to the core. It is the result of special alloying, forging and heat treating that provides a hardness and toughness best suited to grinding needs. This is why you can expect a long, economical grind from Moly-Cop balls. It's the big reason why *Moly-Cop* balls have become the *STANDARD OF COMPARISON AROUND THE WORLD.*

SHEFFIELD

ARMCO®

MOLY-COP

TRADE MARK

COPPER-MOLYBDENUM-ALLOY

Grinding Balls

SHEFFIELD DIVISION

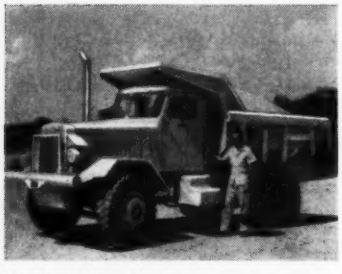
ARMCO STEEL CORPORATION

SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

EXPORT REPRESENTATIVES, THE ARMCO INTERNATIONAL CORPORATION, MIDDLETOWN, OHIO

Put your haulage requirements in experienced hands...

... the **SURE** hands of experience which have specialized in the manufacture of heavy duty trucks for over 53 years. Model 35SL (shown above) carries 35 tons (24 cubic yards, struck). 400 HP Diesel with down-hill retarding hydraulic torque converter. DART-designed-and-built 50,000 lb. front axle and 110,000 lb. capacity drive axle and DART'S famous box girder frame give this truck superior strength.



Model 10SL. DART'S Jr. Workhorse. 10 ton capacity, powered by 150 H. P. diesel driving through a double reduction rear axle. Tires are 12:00 x 24 all around. Hydraulic steering and torque converter, optional.

Model 25SL. The famous DART standard dump truck. 300-335 H. P. diesel engine and hydraulic torque converter with built-in down-hill retarding. Hydraulic power steering. Known and used the world over.

Model 35T. Payload of 35 tons (24 cubic yards, struck). 335 to 400 HP and hydraulic torque converter with built-in down-hill retarding. Heavy-duty 4-speed transmission.

***POWER* for the Climb — *SPEED* for the Haul Road**

HEAVY DUTY TRUCKS EXCLUSIVELY SINCE 1903

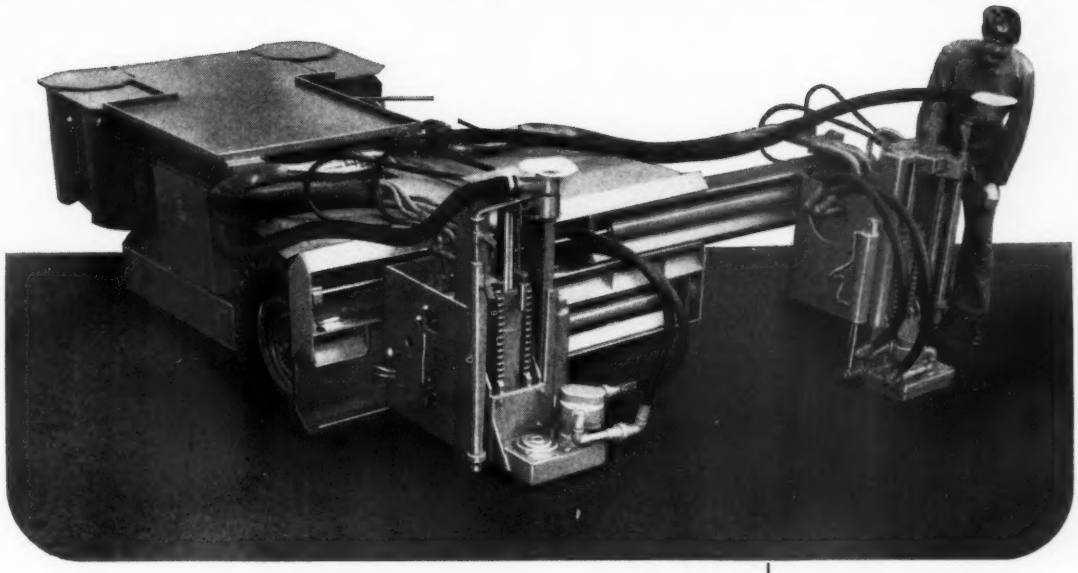
DART TONNAGE ENGINEERED TRUCKS

Kansas City 8, Missouri

D-125

SUBSIDIARY OF THE CARLISLE CORPORATION

FLETCHER DUAL DRILLS with Automatic Feed Control



LATCH DOWN the feed and rotation levers on this Fletcher Model DJ drill — *turn your back on it* — and it will drill a full-depth hole through roof that varies from soft shale to hard sandstone *faster and more efficiently than the best-trained drill operator.* Speed drops and thrust increases when it hits sandstone — instantly — before the bit can be dulled — and thrust drops while rotation and penetration rate increase as softer material is entered.

Fletcher
ROOF CONTROL DRILLS

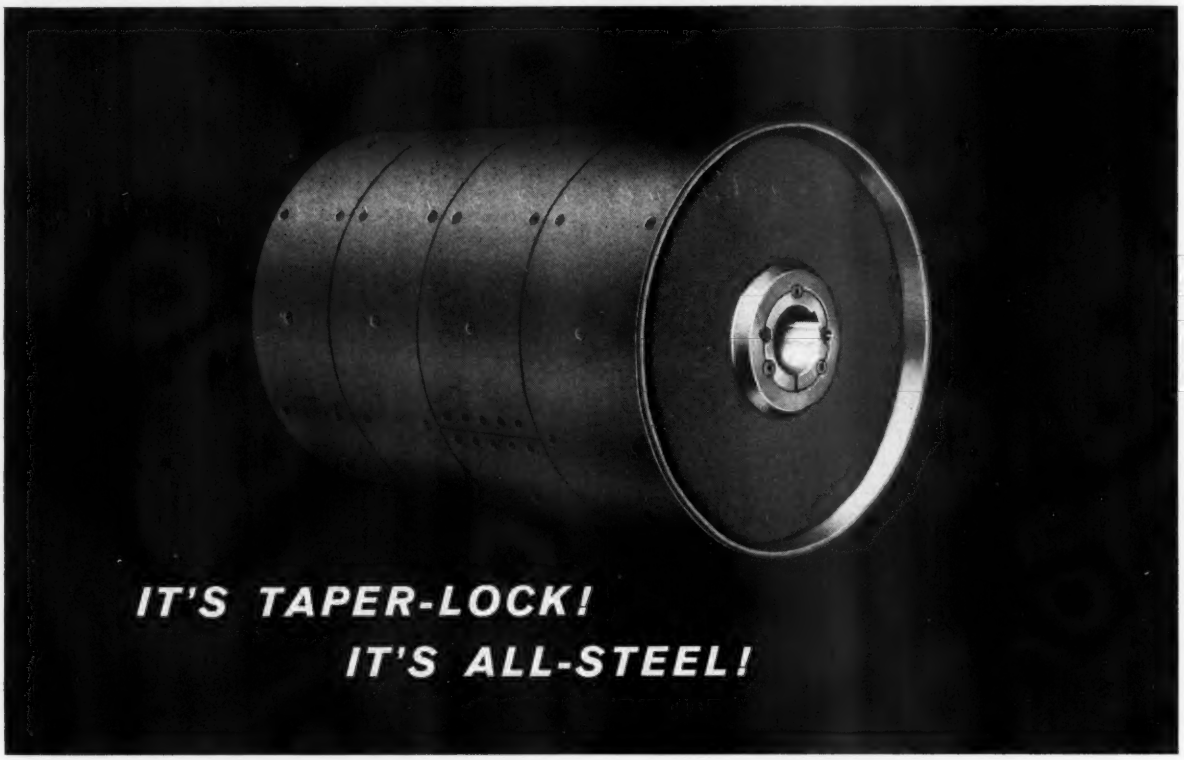
The Results?

- **More bolts installed per shift!**
- **More footage per bit — so lower bit cost!**
- **Every operator gets top results because no experience or "feel" is required!**

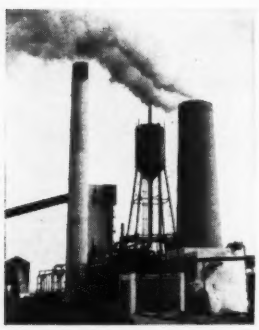
Check with your Fletcher field man on the Model DJ — or any of the many other Fletcher designs. You'll quickly discover *why more Fletcher Drills are in service than all other rotary drills combined!*

J. H. FLETCHER & CO. | P. O. Box 353, HUNTINGTON 8, WEST VIRGINIA
Phone 44186

SEE US AT THE COAL SHOW...MAIN EXHIBIT HALL...DODGE BOOTH 906



The modern Conveyor Pulley for superior performance . . .



One tough application after another proves beyond doubt that you can't beat a lagged, Taper-Lock Steel Conveyor Pulley for the hard jobs! Here is the score on their use in rugged coke plant service. In this particular case the installation was on belts from the quencher and loading belts to cars. The report was made after *three years of use.*

1. **One-third saving on initial cost.**
2. **Saving on maintenance; no redressing of pulley faces.**
3. **No appreciable wear on lagging.**

In addition, these Taper-Lock Steel Conveyor Pulleys provide the further benefits which are inherent in their design:

1. **No bolts to shear.**
2. **Easy on — easy off.**

Taper-Lock Steel Conveyor Pulleys have terrific impact capability. All welds are made by the submerged arc process for 100% strength. Taper-Lock's patented back-up bar permits a weld of the full rim thickness to give 100% penetration. And there are no bolts to give way!

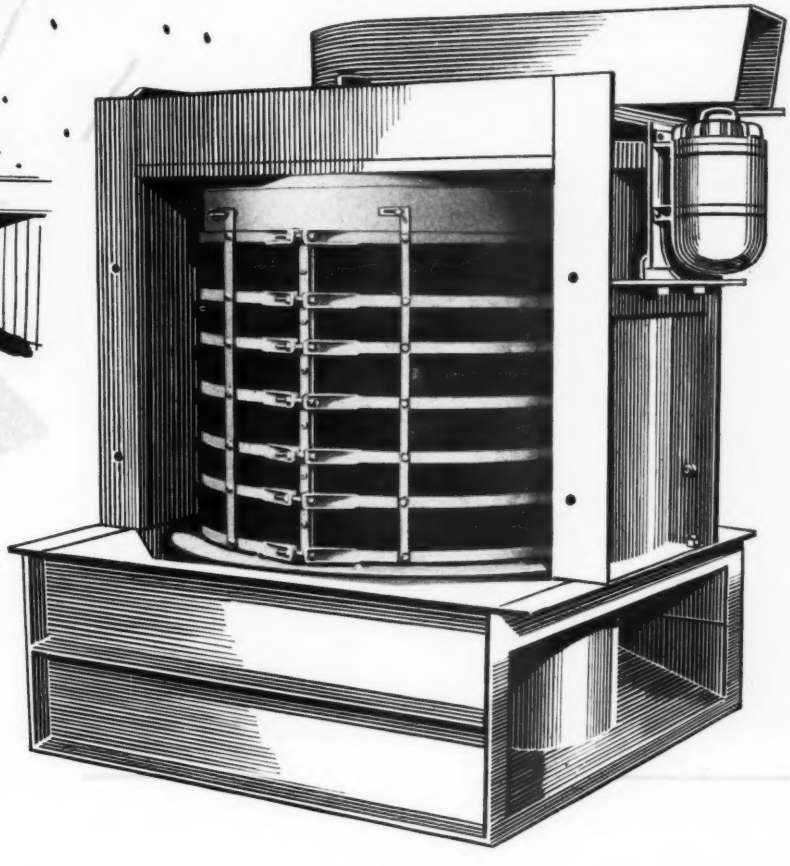
Normally available from stock in all face widths and diameters from 6 inches to 8 feet. *Write for bulletin.*

DODGE MANUFACTURING CORPORATION, 7500 Union St., Mishawaka, Ind.

CALL THE TRANSMISSIONEER your local Dodge Distributor. Factory trained by Dodge he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Equipment" or write us.

DODGE
of Mishawaka, Ind.

Coming to the 1957 Coal Show in Cleveland - May 13...



be sure to see the

SYMONS V-SCREEN®

in action . . .

the only vibrating screen that does not depend on gravity alone to size or dewater coal!

Mail the coupon for your copy of the Symons V-Screen Bulletin 243

NORDBERG MFG. CO., Milwaukee, Wis.

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SYMONS . . . a registered Nordberg trademark known throughout the world

MCJ

Nordberg Mfg. Co., Milwaukee, Wis.
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New Equipment

21782

Goodman Continuous Borer

This rugged, powerful machine has all the capacity, power and maneuverability for entry development, room work, and pillar recovery. With an 8-man crew, including roof bolters, mechanic and foreman it has produced a tons-per-man average as high as 155.3. For a full six-months period it has averaged 724.97 tons per shift with a tons-per-man average of 90.62. At still another mine it consistently produced an average of 861.3 tons per shift, or 123 tons per man, and at the same time reduced face cost per ton to ½ that for conventional mining. This reduced cost included labor and maintenance as well as materials such as roof bolt supplies, rock dust, bits, oil, grease—and after mining over 500,000 tons of coal in steady service the machine has not yet been scheduled for a major overhaul.

The Goodman Continuous Borer is the most consistent high tonnage producing machine on the market today and at every installation has raised the working face efficiency level. It promotes true concentrated working areas requiring fewer man-hours and less supervision. It eliminates hazards associated with drilling and blasting, by cutting an arched path for natural roof support, by advancing rapidly so that rooms are kept open but a short time thus reducing possibilities of roof deterioration. Maintenance cost is low because of simple design featuring large parts and a minimum of moving parts.

The Goodman Borer is an investment that can be written off in terms of greater productivity and lower cost per ton in a surprisingly short period of time.

Goodman Extensible Conveyor—ROPEX®

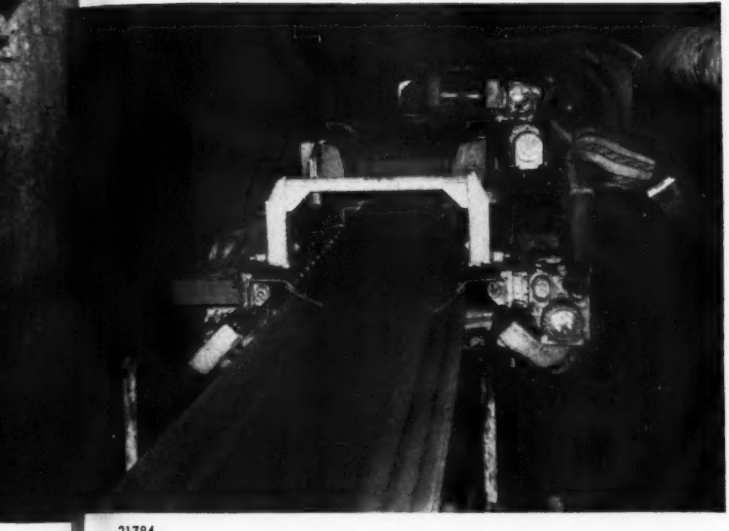
Here's a 36" width belt conveyor that increases or shortens its own length, under its own power, while running coal. Linked to any continuous miner or loader it keeps pace with the face. It eliminates delays and interruptions providing a continuous flow of coal to the out-of-the-mine transportation system. It provides for as much as 200 feet of belt storage for 100 feet of advance before adding belt. Along the line Ropex has no heavy structural framing, no rigid idler assemblies. The belt rides on linked idlers suspended between parallel wire ropes anchored to the head

Patents issued or pending on all machinery illustrated

® Registered Trade-mark

for New Horizons in Coal

section and payed off storage drums on the tail section. Coal moves fast, smoothly and evenly from tail to head with no jolts or bumps to cause shifting or spilling. During extension (1,000′ max.) or retraction, loaded or unloaded, predetermined tension on belt and wire ropes is automatically maintained. Motor driven bridge conveyor between tail section and loading equipment swivels to right or left, has 13½′ range of forward and back travel. And here's another advantage of Ropex—the discharge height at head can be adjusted. There's no need of cribbing or support.



21784

Tread mounted tail section of Ropex bridge connected to a Goodman Continuous Borer. It's always in position to accept load and keep it moving.

Open construction of belt storage framework at tread mounted head section of Ropex. Belt is easy to add, can always be inspected.

21787

21556

Goodman Rope Belt Conveyor

The most useful conveyor you can buy—it's practical anywhere in a mine for any type of service. By eliminating almost everything but the belt itself and the terminal units hours have been chopped off installation and extension time. For example, the Rope Belt can be extended 150 feet in less than one hour between shifts, with no loss in production time, and all necessary parts can be hauled in one mine car or shuttle car. As for carrying capacity the Rope Belt can't be beat. Hinged action of the linked idlers and spring action of the wire ropes "cup" the belt to the load, light or heavy, providing shock-free travel without shifting or spillage. The minimizing of shock also means less wear on belt and idlers, fewer repairs, infrequent replacement. And here are some other advantages to consider: cost of intermediate section of Goodman Rope Belt conveyor is as much as 50% less than for conventional type. Cost of belting can be less because lighter ply belt can frequently be used. Clean-up time along the conveyor is negligible.

Cost savings in all respects, coupled with operating advantages have been proved wherever Goodman Rope Belt conveyors have been installed. Why not investigate now?

At the Coal Show Goodman will be located at their usual area in the lower lakeside hall of Cleveland's Auditorium and welcomes your inspection of modern machines for modern mines.

To be displayed:

- An entirely new model Continuous Borer for lower measures of coal
- A high model Continuous Borer that is establishing new records almost daily
- The Ropex extensible conveyor
- A section of the famous Rope Belt conveyor
- A rubber tired cutting machine
- The newest addition to the Goodman loader line
- A shuttle car that has yet to be out-performed
- A roof bolting drill that really eliminates dust
- The Wilcox auger type miner for low coal

See and hear why equipment of this type represents an investment, not an expenditure.

GOODMAN

MANUFACTURING COMPANY

Halsted Street and 48th Place, Chicago 9, Illinois

CUTTING MACHINES • CONVEYORS • LOADERS

SHUTTLE CARS • LOCOMOTIVES • CONTINUOUS MINERS

Use Genuine Goodman Replacement Parts

WHYTE STRAND WIRE ROPE

1000 & 1 Macwhyte Wire Ropes serve your equipment the sure, dependable way

WHYTE STRAND by Macwhyte is designed to meet your every requirement. It is PREformed for flexibility, and internally lubricated for outstanding service in any operation. Macwhyte Wire Rope is in stock for immediate delivery. Ask for Catalog G-16 and recommendations for the correct wire rope for your equipment.

MACWHYTE COMPANY
2906 Fourteenth Avenue, Kenosha, Wisconsin
Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel and Plastic Coated Wire Rope, and Wire Rope Assemblies. Special catalogs available.

MILL DEPOTS: **New York 4,** 35 Water St. • **Pittsburgh 36,** 353 Old Curry Hollow Road • **Detroit 3,** 75 Oakman Blvd. • **Chicago 6,** 228 S. Desplaines St. • **St. Paul 14,** 2356 Hampden Ave. • **Ft. Worth 1,** P.O. Box 605 • **Portland 9,** 1603 N.W. 14th Ave. • **Seattle 4,** 87 Holgate St. • **San Francisco 7,** 188 King St. • **Los Angeles 21,** 2035 Sacramento St.

1116

a NEW screen...for NEW profits

in coal sizing...

Here's New proof you get MORE...MORE VALUE when you specify A-C! Every feature of the new Model "S" screen has been carefully calculated to give you outstanding performance at lowest possible cost...

1. Added screen cloth life provided by close spacing of clamping bar bolts and by proper camber of deck.

2. Rigid side plates reinforced by vertical angles.

3. Sturdy screen deck frame features heavy channels, diagonal braces, replaceable cross members.

4. No metal-to-metal contact. Full-length rubber buffer strips cushion screen cloth.

5. Screen surface easy to install — Surface slides into place over full-length hook supports. Self-locating clamping bar assembly accommodates screen surface of any thickness.

6. All parts replaceable. All bolted construction, using locknuts.

7. Feed box (optional) absorbs impact of incoming material. Provides uniform distribution when equipped with flow control gate.

8. Back plate (standard) **prevents spillage** — adds structural strength.

9. Springs prevent whipping and breaking of screen cloth by maintaining proper tension.

10. Simplified mechanism assures maintenance economy.

For complete information, see your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. Ask for Bulletin 07B8229.

ALLIS-CHALMERS

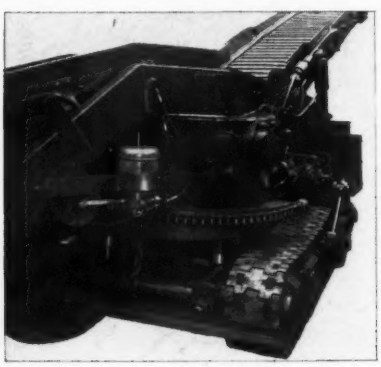
A-4990

"For General Work in coal, rock or ore there is not a better machine on the market today!"

VISIT US AT BOOTH 1512 DURING THE COAL SHOW . . . ask our representatives to give you reports to back up the efficiency and dependability requirements you want in your mine AND CAN HAVE NOW WITH A WHALEY "AUTOMAT"!

—this is the honest appraisal of mining management experiencing the operation of a Whaley "Automat"

At this moment two Whaley "Automats" on the day shift and one on the night shift produce approximately 900 tons of coal per day for one mining company. In addition, these machines also load out two to eight inches of draw slate as well as two to 10 inches of middle parting. For fast projection and all-purpose economy and efficiency, the Whaley "Automat," track-mounted or crawler with hydraulic drive, is maintaining profitable operations for many mining companies. Its low initial cost, low maintenance, low cost per ton of material loaded, plus its versatility for effective entry driving and loading out waste material offers you a mechanical performer that has earned the respect and admiration of every underground mining man, who, when the going gets tough, orders: "Put that Whaley 'Automat' over there and we'll get this stuff out of here!"



IMPORTANT: For those mines now equipped with Whaley "Automats" . . . conversion to our new Hydraulic Drive is readily available. One leading mine has converted four of their "Automats".

MYERS-WHALEY COMPANY

KNOXVILLE TENNESSEE

get maximum use of your facilities . . . with

CF&I ROCK BOLTS

You protect personnel—and mining equipment—against falls, crushes, bumps and other back, face and rib failures when you use CF&I Rock Bolts. What's more, this dependable, increasingly-popular roof support method eliminates timber supports and never blocks service openings such as airways and manways.

For your convenience CF&I offers two popular types of bolts:

Slot-And-Wedge Type—which is driven into place and has excellent load-carrying capacities.

Expansion Shell Type (with Pattin Shell)—which requires no driving with pneumatic equipment and is available in both left hand and right hand threads.

Both types can be used with Realock Chain-Link Fabric for metallic lagging as illustrated.

Ask your nearby CF&I representative for complete details on how you can use these CF&I Rock Bolts to best advantage in your own operations.

CF&I

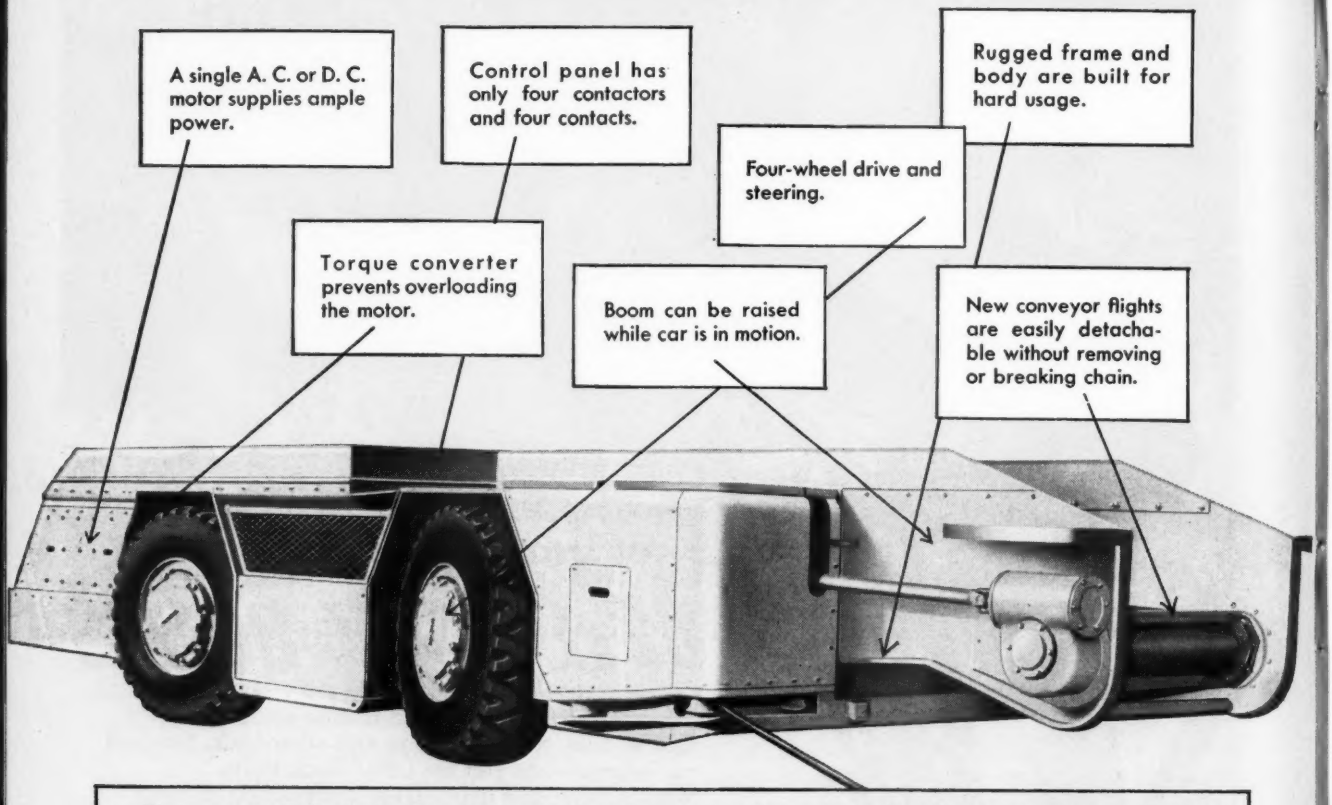
THE COLORADO FUEL AND IRON CORPORATION

DENVER • OAKLAND

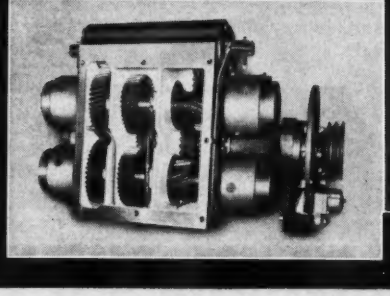
3681

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Chicago • Denver • El Paso • Ft. Worth Grand Junction • Houston • Lincoln • Los Angeles • New Orleans • Oakland • Oklahoma City • Phoenix • Portland (Ore.) • Pueblo • Salt Lake City San Antonio • San Francisco • Seattle • Spokane • Wichita • **CANADIAN REPRESENTATIVES AT:** Calgary • Edmonton • Vancouver • Winnipeg

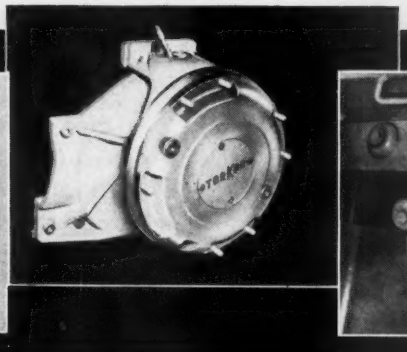
Designed by Mining People to Meet Modern Needs . . .


A single A. C. or D. C. motor supplies ample power.
Control panel has only four contactors and four contacts.
Rugged frame and body are built for hard usage.
Four-wheel drive and steering.
Torque converter prevents overloading the motor.
Boom can be raised while car is in motion.
New conveyor flights are easily detachable without removing or breaking chain.

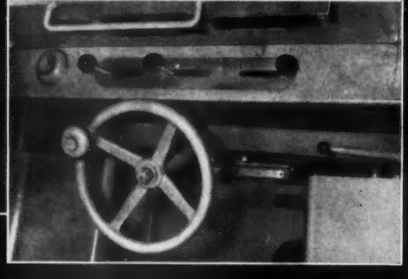
You are cordially invited to make our booth your headquarters at the Exposition, May 13-16.
2029-2128 Upper Lakeside Hall • 2605-2613 Lower Lakeside Hall • Cleveland Public Auditorium



Constant-mesh transmission gives three speeds forward and reverse.



New-type, heavy-duty wheel units are interchangeable.



Controls are simple and conveniently located.

The New National Mine TORKAR*

A. C. or D. C. Shuttle Car

The National Mine Torkar was developed and first built by one of the nation's leading mining companies, using the talents of one of the industry's leading consulting engineers. Operating and maintenance problems encountered in the past were analyzed and present trends in mining were projected in order to envision the problems which might arise in the future.

Engineers were called upon to provide a design which would take care of every requirement considered essential by the operating and maintenance men. The Torkar met the expectations of the mining executives so well that it was decided to turn the car over to National Mine in order that it might be available to the entire mining industry.

Since electrical equipment is the chief source of maintenance costs, it was decided to simplify the electrical system as much as possible. A single, large, non-reversing, fan-cooled motor supplies all of the power requirements, and the control panel has only four contactors and four contacts. To protect the motor against overloading and the resultant damage, a torque converter takes the motor output and transmits it to the constant-mesh transmission. The converter also makes it possible to install either A. C. or D. C. motors, or to convert from one to the other simply by changing the motor, its controls and the cable reel—one of the forward-looking features.

Another source of maintenance costs was greatly reduced by using newly designed, heavy-duty wheel units which are not affected by housing mis-alignments. They employ a spur gear-and-pinion drive having a high torque capacity. The gearing runs in oil. Wheel units are completely interchangeable. The heavy plate bodies and reinforced frames are capable of withstanding years of hard usage. The cars are provided with automatic or zoned lubrication.

All possible operating conveniences were incorporated into the Torkar design. Four-wheel drive and steering, and three speeds forward and reverse make the car very maneuverable. Hydraulic power is sufficient to permit raising the boom while the car is in motion without impairing the steering. Because the hydraulic system has two pumps, one of them driven by the transmission rather than the motor, there is hydraulic pressure to steer and reel as long as the car is in motion—even in event of power failure.

Designed to meet the exacting demands of experienced operating and maintenance men, the Torkar is the most advanced and economical shuttle car available today. Since it has a single prime mover, it can be converted to A. C. or D. C. power quickly and inexpensively without construction alterations. Let your National Mine representative give you full details on this car, or write for literature—today.

*Trademark

National Mine Service Company

National Mine Service Company

564 Alcoa Building • Pittsburgh 19, Pennsylvania

All-State Division, Logan, W. Va.
Anthracite Division, Forty Fort, Pa.
Ashland Division, Ashland, Ky.
Bemeco Division, Beckley, W. Va.
Kentucky-Virginia Division, Jenkins, Ky.
Western Kentucky Division, Madisonville, Ky.
Whiteman Division, Indiana, Pa. Morgantown, W. Va.

Du Pont NILITE* for safer, powerful, low-cost shooting in dry work!

"Got any medium or large diameter dry holes to shoot? Man, if you don't use me, you're just plain wastin' money! Me? I'm NILITE: Du Pont's new ammonium nitrate blasting agent. Just pour me alone in easy shooting holes or as a top load in medium-hard ones. You'll get excellent spreading action, thanks to my over-60% weight-strength—and believe me, my price tag's low!

"Your work'll be safer, too. Caps, friction, shock and Primacord don't affect ol' NILITE. I'm also non-headache-producing, so your men can load faster, with an extra margin of safety. (For maximum safety, initiate me with Du Pont's "Nitramite®" Primer, although explosives of at least 50% strength can also do it.)

"I come two ways: in non-expanding round burlap-asphalt bags of 7", 8"and 9" dia. (larger sizes on request) for loading directly into holes—and bulk-packed, in 50- and 100-lb. multi-wall paper sacks that resist tearing and abrasion, for pouring into holes.

"Cut shooting costs—get all the power you need—by using me. That's NILITE: another field-tested Du Pont product you can bank on!" Call our man or write: E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.

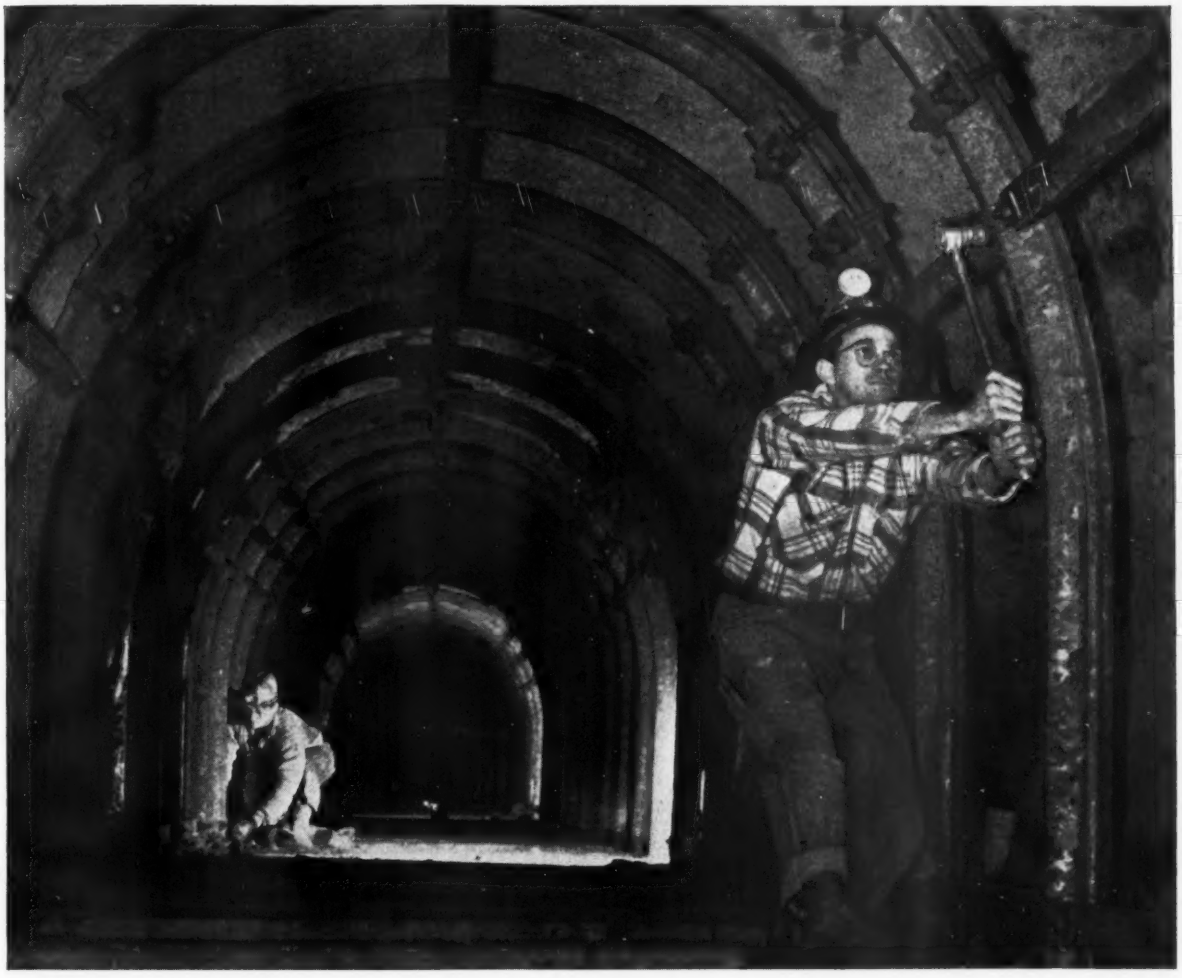
* Registration applied for.

See us at Booth No. 214, American Mining Congress 1957 Coal Convention, May 13 to 16, Cleveland, O.

DU PONT
BLASTING AGENTS
Products of Du Pont Research

DU PONT

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



How quickly do Yieldable Arches pay for themselves?

That's the big question, and a natural one to ask before investing in a high-quality roof support like the Bethlehem Yieldable Arch.

The experience of one iron ore mine, extreme perhaps, may be an indication. The conditions were difficult, and the mine had been using timbers 14 in. and more in diameter, practically touching one another. One by one, these timbers failed in from 4 to 6 weeks.

So they installed Bethlehem Yieldable Arch sets in the caving area. Since installation, sets have yielded sufficiently to bring the roof under control, and mining operations have continued steadily. The operators have conservatively estimated that this installation paid for itself within six months!

While this case is hardly a typical one, this much is sure: in mines having heavy roof conditions the Yieldable Arch will give improved roof support, and will pay for itself gratifyingly soon. That's because no rigid support can indefinitely withstand the dynamic pressures caused by the weight and subsidence of the overburden. Periodic replacement of rigid supports is necessary. The Yieldable Arch, on the other hand, is designed to "give," thus allowing the ground to relax slowly and form its own pressure arch.

Yieldable Arch sets are recoverable, too, for use elsewhere in the mine. They are easy to install without special equipment or costly supervision. One of our engineers will be glad to talk with you about the Yieldable Arch; you can reach him through the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

HERE'S LOADER MOBILITY . . . EXCAVATING STRENGTH

LOADS 1½ CU YD AT A PASS . . . 2¼ yd with light materials bucket. Lifts up to 11,200 lb.

WORKS RIGHT UP ON A STOCKPILE where wheels dig in. Can build stockpiles higher, store many more yards of material in a given area.

TURNS IN ITS TRACKS . . . where many smaller loaders have to jockey.

DIGS INTO HARD-PACKED MATERIAL . . . exerts 20,000-lb break-out force, with 72 net engine hp and modern bucket design.

These are just four examples of how an Allis-Chalmers HD-6G tractor shovel offers a combination of strength, traction, flotation and mobility that enables it to replace a fleet of part-time specialized machines. You can count on it to boost production the year round. Ask your Allis-Chalmers dealer about the HD-6G . . . also the three larger tractor shovels with capacities up to 4 cu yd. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

MAX-WEAR ALLOY

makes parts like these last longer

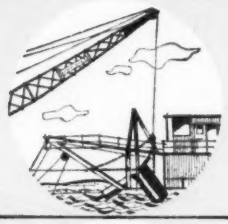
DREDGE BUCKET

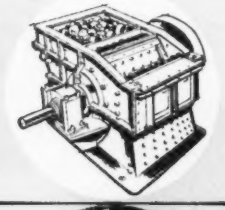
ROCK CRUSHER

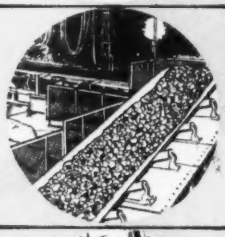
CHUTE LINING

WEAR PLATE

GROUSER BARS







—keeps equipment on the job

Max-Wear Alloy Steel (13% manganese, 2% nickel) is *work hardening!* This means the more it's used the harder the surface becomes (up to 500/550 BHN). But only the surface hardens; the interior of the steel is unaffected. As a result, Max-Wear parts have truly wear-resistant surfaces *plus* high strength and toughness internally.

When you make parts like those shown with Crucible Max-Wear, you reduce downtime, cut repair and replacement costs. For Max-Wear resists repeated heavy impacts and abrasion—just what you need on jobs where equipment takes a bad beating.

Crucible Max-Wear is especially practical for repairs in the field. It can be formed cold or at *red heat,* and is easily shear or torch cut and welded. No annealing is necessary after these operations—a big advantage in the field.

Max-Wear is now available in rounds, squares, plates and special grouser shapes. If you are looking for an easy-to-use alloy steel that will give you longer service under impact, wear and abrasion, try Crucible Max-Wear. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

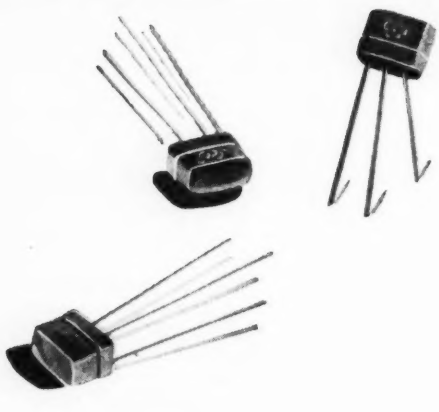
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Sulphur

helps to create
Headline Products

GERMANIUM



Not too long ago this relatively rare metal was a laboratory curiosity. What to do with it? Today, it's the heart of the tiny transistor—the latest giant of electronics!

What's the connection between Sulphur and Germanium?

There are two, in fact. One is man-made, involving the routine leaching of Germanium ores with Sulphuric Acid prior to tetrachloride distillation. The other takes advantage of a peculiar property of the natural mineral, Germanium Sulphide. This mineral can be volatilized and then sublimed, providing an effective method of separating the Germanium from gangue material. The process is called "Concentration of Germanium by Sulphide Sublimation".

Again Sulphur, through its major derivative, Sulphuric Acid, and a natural sulphide play an important role in our ever-expanding economy. It is difficult to find many items in the broad chemical-metallurgical field that do not somewhere along the production line make use of Sulphur or a derivative.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.
811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units
- Newgulf, Texas
- Moss Bluff, Texas
- Spindletop, Texas
- Worland, Wyoming

water-proofing winter-proofing

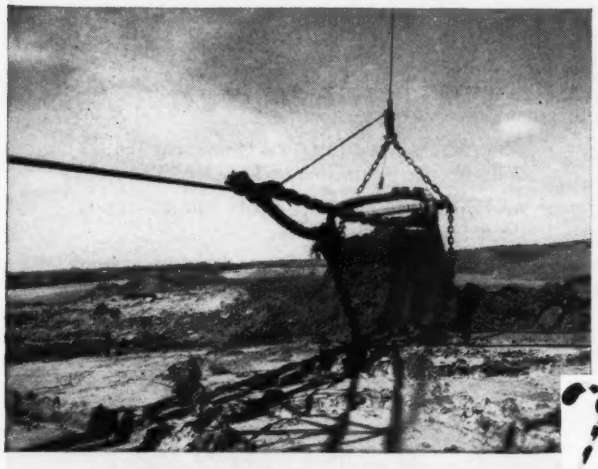
- **DECREASE WATER ABSORPTION**—Permatreated coal repels water.
- **FREEZE PROOF**—Permatreated coal resists freezing and eliminates frozen car pockets.
- **REDUCE MOISTURE**—Add 300,000 BTU per ton for each 1% reduction in moisture.
- **DUST PROOF—ODORLESS**—Permatreated coal insures dustless deliveries and handling, odorless storage and burning.
- **ELIMINATE WINDAGE LOSS**—that results in lost weight claims and air pollution complaints.
- **AVOID CORROSION**—Non-corrosive Permatreat can't pit or corrode stoker equipment, or rolling stock.
- **MAINTAIN QUALITY**—Permatreat reduces deterioration from weathering.
- **CONTROL BULK DENSITY**—Permatreat insures uniform coke production and quality.
- **ASHLAND PERMATREAT COAL SPRAY**—Lasts the life of the coal.
- **SPECIAL ADVISORY SERVICE**—Available from nationally recognized authorities on coal treating.

ASHLAND OIL & REFINING COMPANY
Ashland, Kentucky

Ashland PERMATREAT

TIGER BRAND WIRE ROPE

Building the Long Sault Dam. When completed, this dam will contain approximately 653,000 cu. yds. of concrete. The three large gantry cranes used in pouring this concrete are rigged with Tiger Brand Wire Ropes.



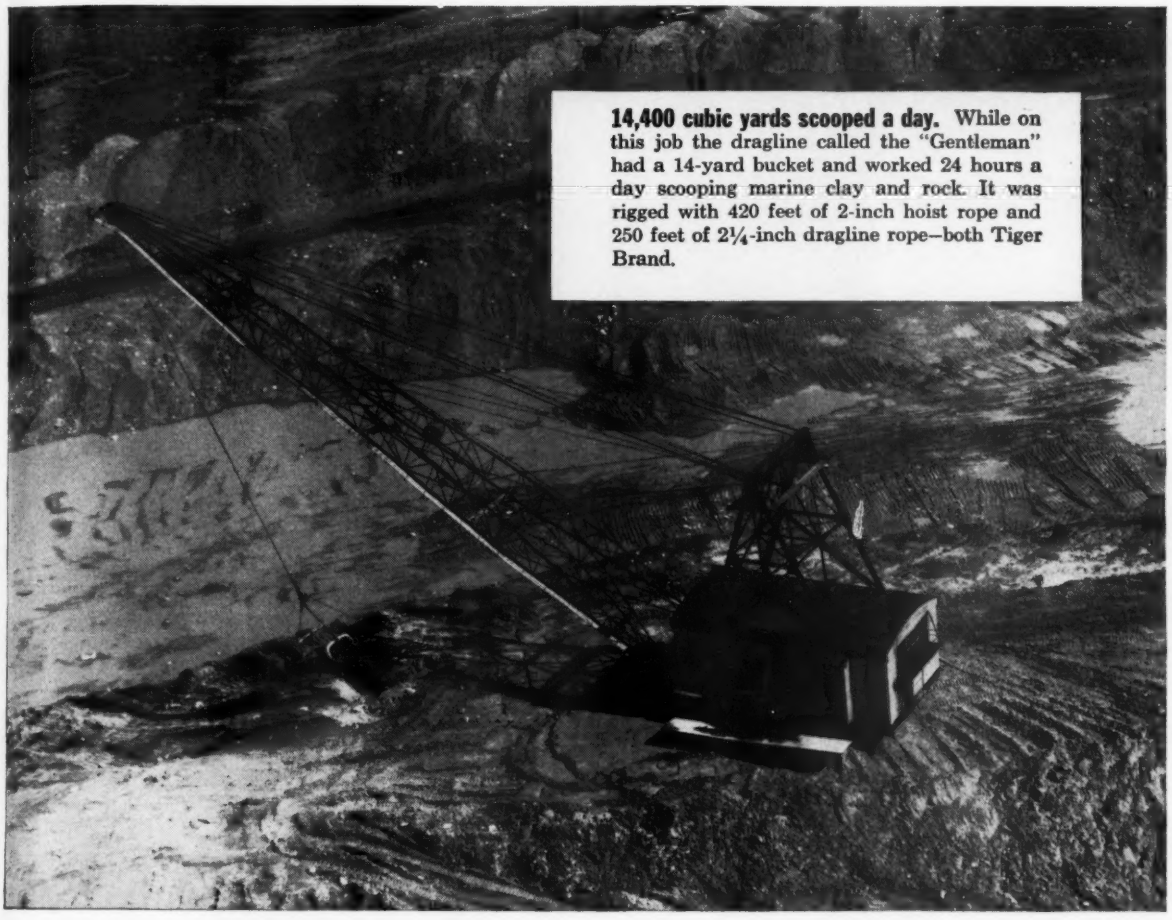
Sticky marine clay weighs almost twice as much as regular overburden, puts greater strain on wire rope and equipment.

Shovel rope takes a beating and Tiger Brand is made to withstand rough service and heavy abrasion.

at work on St. Lawrence Seaway and Power Projects

THE FABULOUS ST. LAWRENCE SEAWAY and St. Lawrence Power Projects are the largest construction undertakings of all time, costing over $900 million for the Seaway and power development. To keep the big machines working at top speed requires all kinds of wire rope—and most of it is USS American Tiger Brand.

Speed was such an important factor on this job that all equipment and supplies were selected with trouble-free performance in mind. American Steel & Wire set up a wire rope warehouse nearby for quick deliveries of any type of wire rope needed. Here are a few illustrations of the many jobs being performed by Tiger Brand Wire Rope.



14,400 cubic yards scooped a day. While on this job the dragline called the "Gentleman" had a 14-yard bucket and worked 24 hours a day scooping marine clay and rock. It was rigged with 420 feet of 2-inch hoist rope and 250 feet of 2¼-inch dragline rope—both Tiger Brand.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

USS

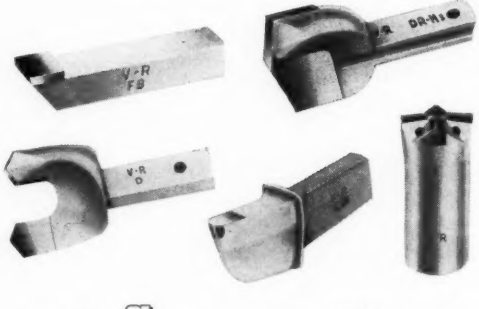
Excellay Preformed

UNITED STATES STEEL

"Be sure to see the latest V-R developments in carbide tipped coal mining bits when you visit the Coal Show—Cleveland, May 13-16.

"There will be experienced V-R mining men on hand to discuss your problems and requirements.

"I'll be looking for you there."



Vascoloy-Ramet Corporation

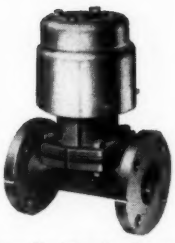
SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

876 Market Street • Waukegan, Illinois

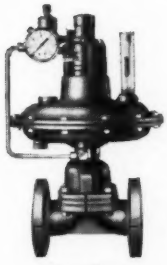
MANUFACTURERS OF CEMENTED CARBIDES • CUTTER BITS • FINGER BITS • AUGER BITS • ROTARY BITS • ROOF BITS • PERCUSSION BITS • CARBIDE INSERTS

M-599

Barber-Coleman



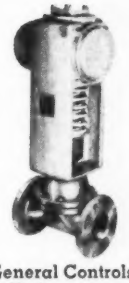
Bendix-Westinghouse Rotochamber



Conoflow

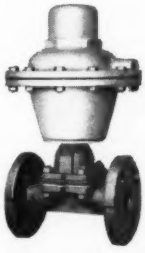
Fisher Governor

Foxboro Reversible Stabiflo

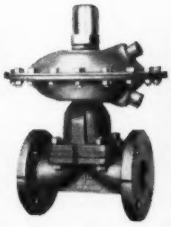


General Controls Hydramotor

GRINNELL-SAUNDERS DIAPHRAGM VALVES with famous name POWER OPERATORS

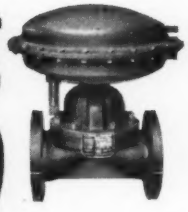


Grinnell Air Motor, Spring Loaded



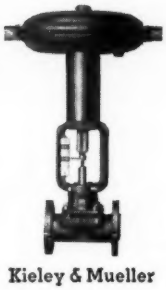
Grinnell Air Motor, Double-Acting

Grinnell Piston



Hammel-Dahl Close-Coupled

Hammel-Dahl Preloaded



Kieley & Mueller

Mason-Neilan

Minneapolis-Honeywell

Philadelphia Gear Limitorque

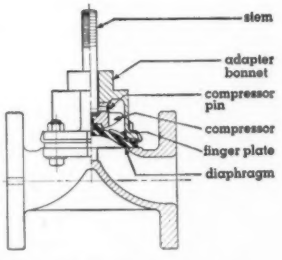
Taylor Motosteel

GRINNELL-SAUNDERS Diaphragm Valves are easily equipped for power operation — by combining any of numerous power operators, a sliding stem bonnet assembly, and a valve body. The sliding stem bonnet can be modified to accommodate any make of power operator, pneumatic or electric.

Grinnell-Saunders Diaphragm Valves are unsurpassed for handling materials as diversified as corrosive fluids, gases, beverages, foods . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

The operating principal of the Grinnell-Saunders Diaphragm Valve is simple. The resilient, flexible diaphragm is lifted high when the compressor is raised and pressed tight against the body weir when the compressor is lowered.

Grinnell valves are available with body, lining, and diaphragm materials to meet different service conditions. For further information, write Grinnell Company, Inc., 229 West Exchange St., Providence, R. I.

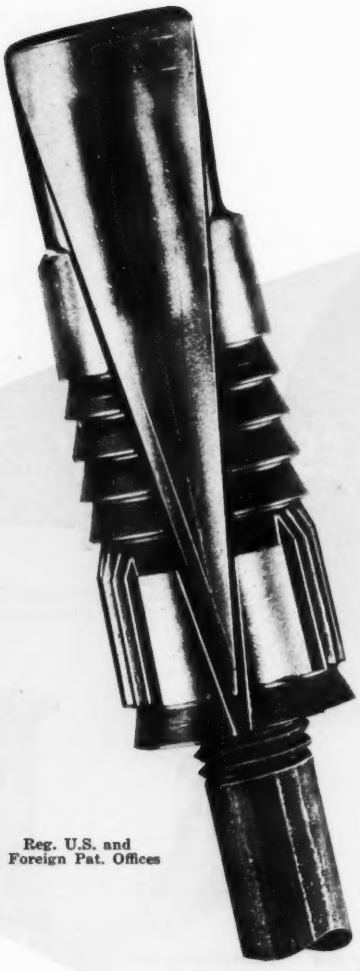


This sliding stem bonnet is specially designed for power operation. The power operator is attached to the adapter bonnet and to the threaded end of its free-sliding stem. Thus, the operating force is applied *directly*. The stem, in turn, is directly connected to the compressor which opens and closes the valve when power is applied. This sliding stem bonnet is interchangeable with other bonnet designs.

GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Reg. U.S. and
Foreign Pat. Offices

THERE'S A BIG DIFFERENCE

4 Million* Roof Bolts Per Month—Now Being Installed In Mines—

* Estimated usage in 1956

THE TREMENDOUS growth of roof bolting can be directly traced to the advantages it offers and gives the mines that have replaced conventional timbering methods with roof bolts. Roof falls that usually result in accidents, operating delays and clean-up costs have been reduced to a minimum. Safety records are greatly improved while increases in production have materially reduced the average cost per ton, per man. Being the largest exclusive manufacturer of roof bolting products—PATTIN Manufacturing Company has the largest and most complete line of outstanding shells, bolts, etc. Our roof bolting experts are available for consultations and tests. Write or phone us at your convenience.

Shown above is the PATTIN style D-1 expansion shell. Samples of the D-1, D-2 or D-3 will be furnished upon request.

In Western States

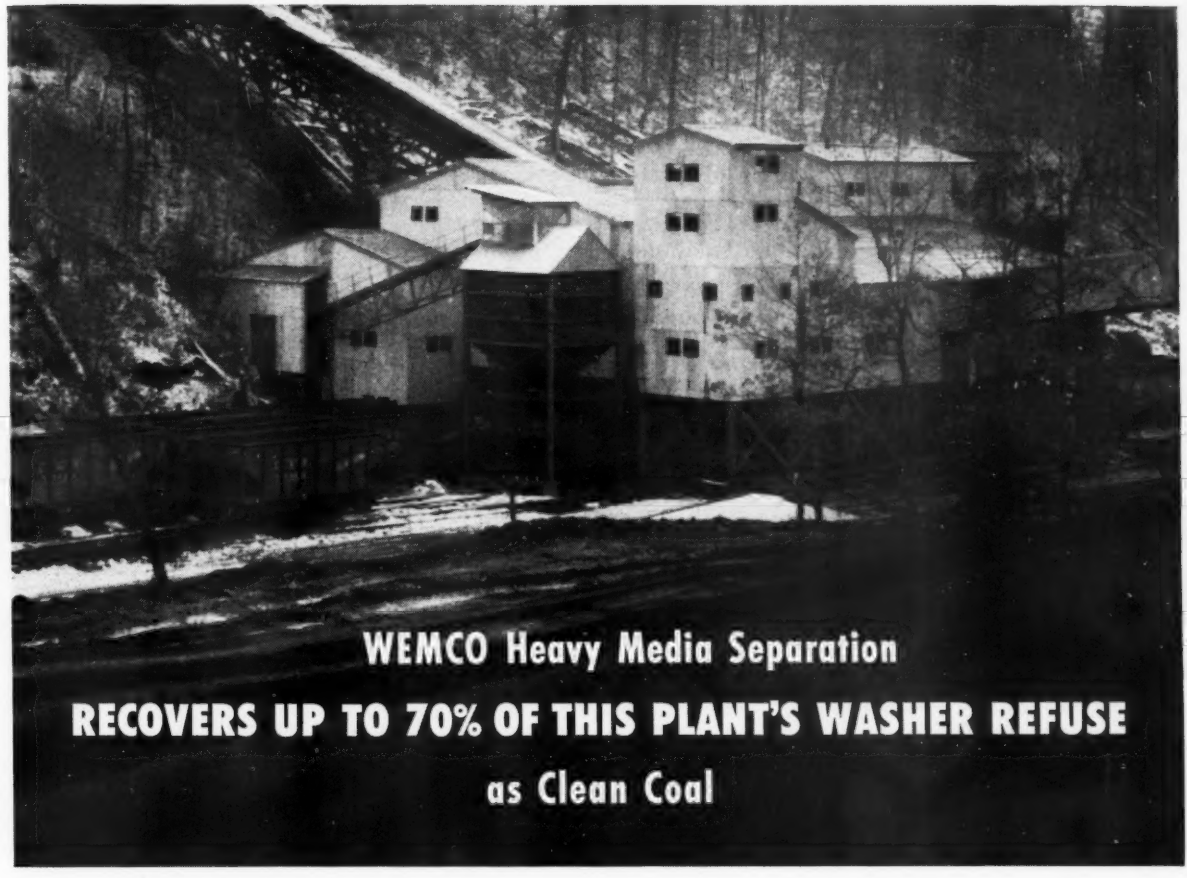
PATTIN expansion shells are available and serviced exclusively through Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies may contact them direct for information and consultation.

PATTIN ***"The Pioneer in Roof Bolting"***

PATTIN MANUFACTURING COMPANY

"69th Year"

MARIETTA, OHIO

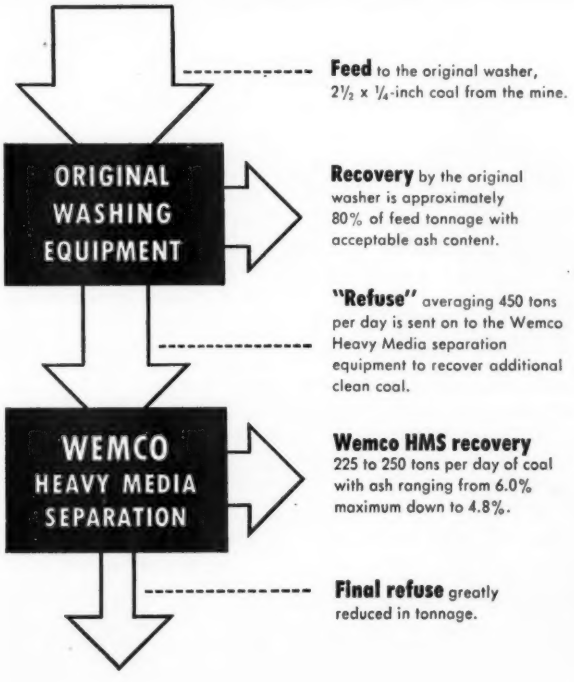


WEMCO Heavy Media Separation

RECOVERS UP TO 70% OF THIS PLANT'S WASHER REFUSE

as Clean Coal

The Jewell Ridge story at a glance



Feed to the original washer, 2½ x ¼-inch coal from the mine.

Recovery by the original washer is approximately 80% of feed tonnage with acceptable ash content.

"Refuse" averaging 450 tons per day is sent on to the Wemco Heavy Media separation equipment to recover additional clean coal.

Wemco HMS recovery 225 to 250 tons per day of coal with ash ranging from 6.0% maximum down to 4.8%.

Final refuse greatly reduced in tonnage.

"We are now recovering 225 to 250 tons per day of clean coal that was formerly lost," says the Division Engineer at Jewell Ridge Coal Company in Tilford, Kentucky.

Lab analysis at Jewell Ridge had shown a large loss of coal in the refuse of the original washing plant. A Wemco Heavy Media plant (of Mobil-Mill design) was added to treat the large volume of refuse. It was expected to recover a coal of 11 percent ash, saleable at a low price. But in actual operation, the Wemco Heavy Media equipment has been recovering 225 to 250 tons per day of coal in a range from 4.8% ash to 6.0% maximum. (Jewell Ridge Coal Company has now ordered a second Wemco Heavy Media plant.)

A Wemco HMS Mobil-Mill can earn extra profits on your mine too. Write today for full information.

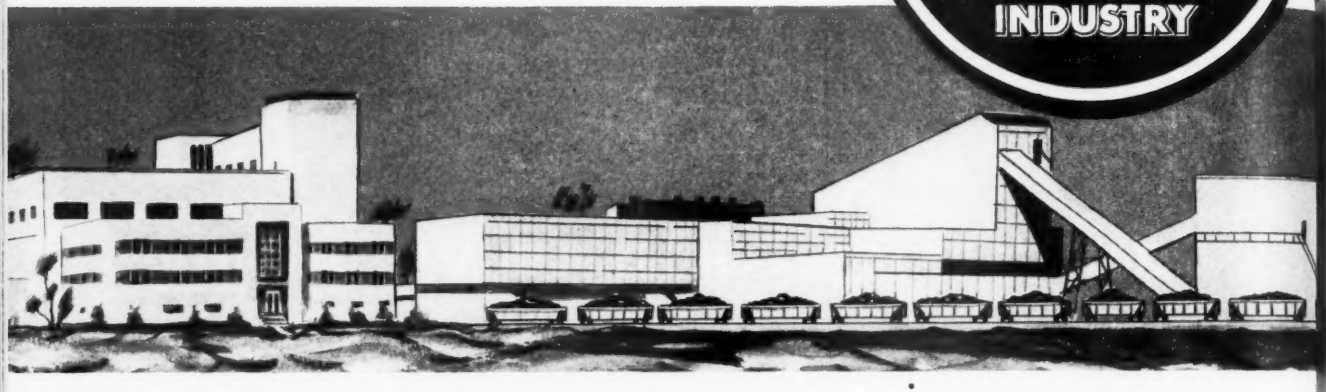
WEMCO®
WESTERN MACHINERY COMPANY

650 5th Street • San Francisco 7, California
Representatives throughout the United States and Canada and in major countries around the world.

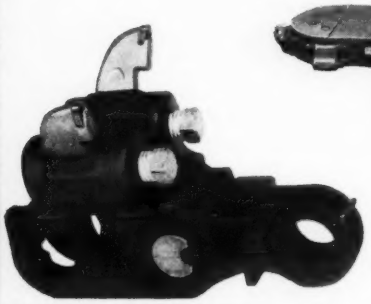
CINCINNATI MINE offers a complete line of Chains and Bits for every type of Mining Machine

CINCINNATI MINE offers the most complete line of CHAINS, BITS and BARS for CONVENTIONAL or CONTINUOUS MINING MACHINES for all cutting conditions. "CINCINNATI" is also recognized as the leader in research, design and practical application of this equipment. This leadership is based on more than 30 years of EXPERIENCE AND SPECIALIZATION . . . backed by highly trained personnel with a sincere desire to better serve the Industry. SEE YOU AT OUR BOOTH NO. 2715 DURING THE MINING CONGRESS CONVENTION.

PROUD OF OUR CONTRIBUTION TO THE PROGRESS OF A GREAT INDUSTRY



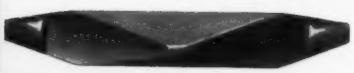
Cincinnati Cutter Bar Assembly Available For Any Cutting Job.



TYPE 185 . . . used on Joy Continuous Mining Machines where flanges are NOT required. Chain features a SERIES OF SELF CLEANING DEVICES.

STANDARD KERF TRIMMING CHAIN for use on boring type Continuous Miner. Sturdy, rivetless type construction.

CINCINNATI DUPLEX CHAIN AND BIT is recommended for maximum cutting efficiency and for use on all types of cutting machines.



DUPLEX F-TYPE TIPPED BIT. Where cutting conditions are favorable, it is undoubtedly the most economical tipped bit on the market.

REPRESENTATIVES AT YOUR SERVICE

FRANK ARMSTRONG
Kenilworth, Utah

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Carlsbad, New Mexico

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E. S. STEPHENSON & CO. LTD.
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J. T. SUDDUTH & CO. INC.
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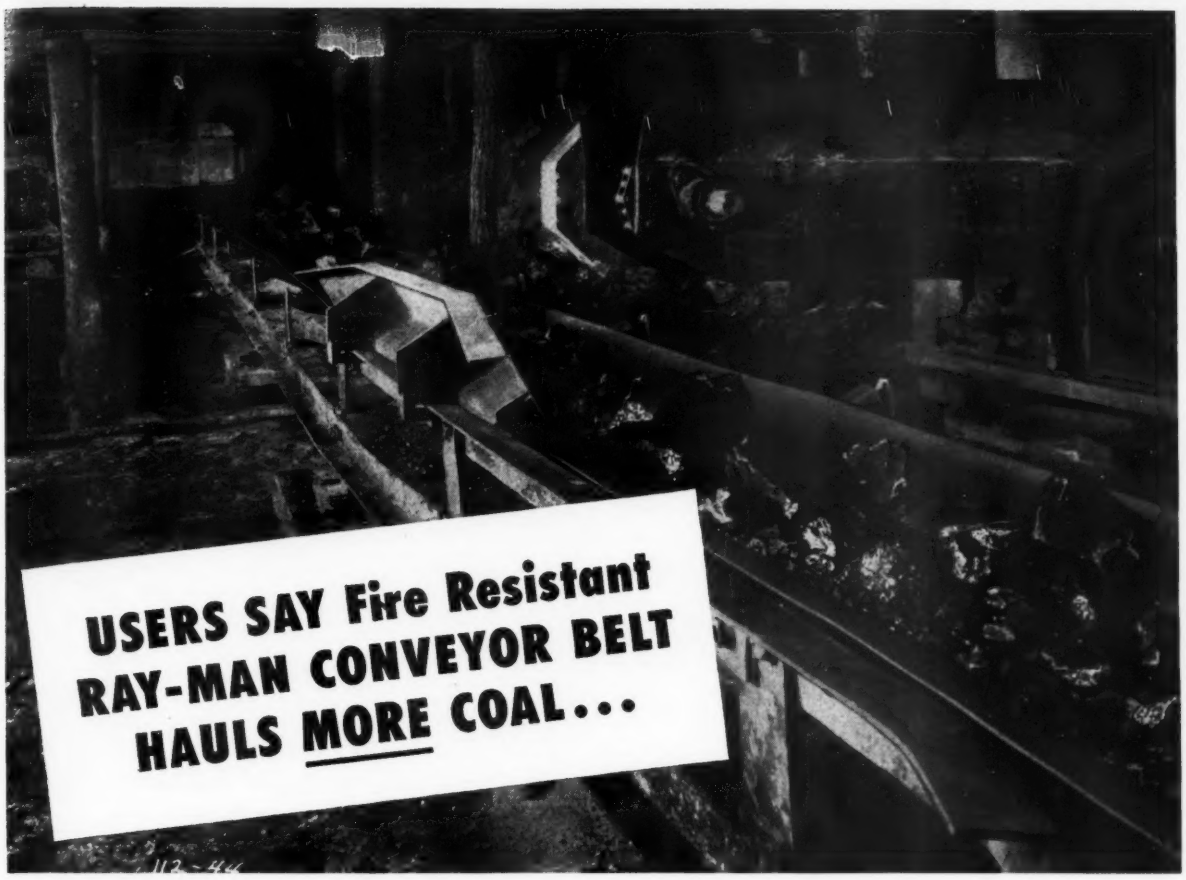
Denver, Colo.

the **CINCINNATI MINE MACHINERY CO.**

CINCINNATI 25, OHIO



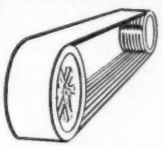
...Gives you "More Use per Dollar"

R/M engineering makes the difference! Special cushioned strength members are made of newest special industrial fibers. Strong, resilient outer plies are double compensated to relieve stress and provide exceptional flexibility. Ray-Man Conveyor Belt trains naturally, troughs easily . . . handles *fuller, heavier* loads even where small pulleys are required in low-head room installations!

Resists gouging, tearing and ripping better than other constructions. Requires no breaker strip. R/M's exclusive "XDC" Cover gives the belt much greater protection against wear, tear, cuts and abrasions. It's mildew-proof, moisture resistant and—*now*—available in special construction with Bureau of Mines' acceptance designation: "Fire Resistant, U.S.B.M. No. 28-10." You can't use a *better handling, longer lasting . . . safer* belt in your underground mining operations!

Let an R/M representative show you special advantages of other feature R/M conveyor belts . . . extra-cushioned Homocord, for unusually abrasive shock loading . . . R/M Tension-Master for extra long slope lifts, high tensions. Whatever your requirements, if you *specify* R/M Conveyor Belts . . . you *get* "More Use per Dollar." Write for Conveyor Belt Bulletins.

More Dependable Mine Drives with R/M Poly-V®



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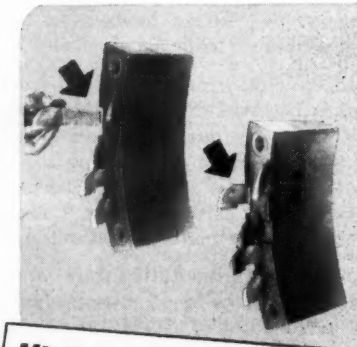

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Editorials

ROBERT W. VAN EVERA, *Editor*

APRIL, 1957

— On Productivity and Better Mousetraps —

THE importance of extensive research respecting the mineral industries has been stressed in Information Circular 7754, published by the United States Bureau of Mines in cooperation with Bituminous Coal Research, Inc. The circular, under the section, "Mining Methods and Equipment," lists as "research possibilities" a number of subjects —for example: "develop rugged mining machines . . ." and "develop improved mining methods and machines. . . ." Unlike some of the more scientific subjects of fundamental research and various long range projects which mining companies are unlikely to be able to undertake on their own, these are **application** problems—which many miners may not even recognize as research.

The major role in the development of new applications has been performed by private enterprise. This is as it should be. The Bureau of Mines, the United States Geological Survey, the Atomic Energy Commission and other Federal and State agencies must cooperate in developing the important fundamental data that is required—through their pursuit of basic research.

The field of applied research has grown beyond simply inventing new company secrets to guard behind locked doors. It is a matter of industry-wide and nationwide importance. But that doesn't mean that it must be performed by Government.

J. D. A. Morrow, former chairman of the board of Joy Manufacturing Co., appearing on behalf of the Manufacturers Division of the American Mining Congress before a House of Representatives subcommittee on Coal Research, pointed out why applied research on mining methods and equipment should be left primarily to the manufacturers of mining machinery and to the mine operators.

Lest he be misunderstood, Morrow made it clear "that certain governmental research—particularly by the Bureau of Mines and by some of the State mining departments—has been, and in the future can be, helpful." He cited specific examples of their work that has been highly beneficial to the mining equipment industry, and suggested other research studies which Government agencies should consider making for the benefit of all Americans.

Basically, however, the development of new mining machinery and of new methods of extracting mineral values constitutes a challenge, an opportunity and a responsibility of the mining industry itself. It would be impractical and uneconomic for the Government to undertake extensive projects in the methods and equipment fields.

The specialized manpower which has been recruited and trained by the manufacturing and operating companies would have to be duplicated by the Government. In view of the existing shortage of qualified engineers and the high cost of training them, the cost to the American taxpayer would be high, and there is still no assurance that they would be able to produce. The development engineer who has access to the shops or mines of his employer is much better equipped for his job than the one who has only a drafting table or a chemistry lab.

Hand in hand with applications engineering must go manufacturing, distribution, and full scale installations on the job. Progress requires the wholehearted cooperation of all concerned. Consultants, manufacturers, mine operators and research institutions—whether profit, non-profit, or Government—have all played important parts in the progressive strides made by the mining industry toward greater productivity.

The record thus far may be pointed to with pride, but it is just a scratch on the surface of the big job ahead. An increasing number of companies which derive income from mining, directly or indirectly, must concentrate more effort and attention to making a "better mousetrap" or be caught in the traps of high costs and obsolescence.

The future of coal mining looks bright. The author believes that one sure way to keep it this way is to increase efficiency not only with better machines, but also by using better men to operate them. He feels that careful selection of personnel should help to achieve that goal and describes his company's experience in developing and installing a program of . . .

Personnel Evaluation And Training

By C. R. NAILLER
President, Christopher Coal Co.

THIS article is not intended to cover in any authoritative manner the very large problem of how to select coal mine personnel through the use of a testing program. Rather, it is to demonstrate how one coal company did institute a testing program in such a manner that all members of the operating organization became thoroughly convinced of its value and derived practical benefit from the program. Our company definitely feels that a great deal more experience is needed in the application and use of personnel tests than we have been able to acquire before any coal company could presume that such a program is fairly infallible or that it is using such facilities to the limit. We hope that the disclosures we can make, as to the benefits derived from our relatively simple testing program, will spur other coal operating organizations to adopt similar testing programs. Through the further development of this art it is possible we could all benefit.

Too Many Failures

Christopher Coal Co., like most coal companies, felt that it was doing a very poor job in selection of supervisory personnel and, to a lesser degree, in the selection of the United Mine Worker employe. Selection was previously accomplished in the company, as it is in the coal industry generally, by relying on one man's judgment of another, and it was quite apparent that the success of this method was wholly dependent upon the ability of the judge. Although this method was at times fairly successful, we felt that a better selection job must be done because of the plain fact that we were having too many failures. The top management of the company had, for a long time, felt that the successful application of personnel testing programs, as used in other industries and in the Armed Forces of the United States, could be applied. However, when the use of a testing program for the selection of supervisory personnel was suggested to the lower echelon of management, these practical minded people had a distinct adversion to such a suggestion. In spite of the fact that these very people deplored the percentage of failures and admitted they could not find a suitable number of supervisory applicants with their method of selection, they were still very proud of their individual ability to judge people and did not want to give up any of these prerogatives. We did finally agree that it would be a healthier situation if we could improve our method of selection and raise our percentage of accuracy in predicting success on the job, especially in the supervisory category.

Conditions Favorable for Change

Fortunately the company was in an enviable position to undertake the installation of a testing program for the following reasons:

We were in close proximity to West Virginia University, and Dr. Quin F. Curtis, Head of the Psychology Department, was willing to make his facilities available to us in any undertaking.

We had in our personnel department Mr. Al Rowe, a rather recent graduate of the University in the School of Business Administration, who was well-grounded in personnel testing and psychology.

We were also about to embark upon an expansion program at our mines which would require the employment of a large number of miners and supervisors. Our already-existing group of management personnel were the best of a group comprising almost twice that number which, due to a previous recession in the coal business, had been reduced to the then presently employed group. This, naturally, was accomplished by retaining those supervisors showing the greatest ability and best performance on the job.

When we explained to the lower echelon of management that we would test our testing program by evaluating it against their own judgment or evaluation of the existing management group, we were assured of their complete cooperation. In other words, if a testing program was good enough to prove that they were right, then the testing program must be good.

Developing a Program

With these various factors in mind, we then set about developing the personnel testing program in the following manner.

We started out by first asking the question, "What do we want to measure?" The conclusion was—we want to know what significant differences there were between a man who is considered a "top" employe and a man who is considered a "bottom" employe, and, after finding these differences, to provide ourselves with tools to help us identify people with these qualities when selecting new employes or selecting present employes for promotion.

The next step was to select the type of tests we felt were best suited for our particular company. During the summer of 1953 we had several conferences with Dr. Curtis, and several other professors in the Psychology Department at the University. After many discussions of the various phases of the situation (such as what we wanted to measure, the type of people

A coal company's employment manager conducts preliminary interview with job applicants. The interview is brief but serves to weed out the obvious undesirables

we had to deal with, the amount of time we could afford to spend, etc.) we finally selected three tests, one for the United Mine Worker personnel and two for supervisory personnel. Later we added a second test for United Mine Worker applicants.

Started September 1953

After selecting the various tests we embarked on our testing program, very slowly at first so as not to arouse too many objections. We started giving our tests in September 1953 to United Mine Worker personnel being called back from the unemployed panels, for background purposes only since they were entitled to their jobs by reason of seniority and the results of the tests had no effect on their job rights. Even though we had no past experience on which to base our findings, we were encouraged to learn that the men classified as the better workers, by their foremen, usually made the higher test scores.

We were in a more favorable position for testing supervisory personnel, since we were able to find out what made a top foreman "tick" by testing all foremen in our employ at that time. However, before the actual testing, it was necessary to have the foremen ranked from top to bottom by their immediate supervisors (that is section foremen by the superintendent, general mine foreman and their shift foreman; shift foremen by the superintendent, general mine foreman and general superintendent; general mine foremen by the superintendent, general superintendent and president, and so on until all mine supervisory personnel, up to and including the general mine foremen, were ranked in their occupational classifications). Thus each man was ranked by three other individuals, each of these grading independently of the other.

The system we used could be named "The Peeling Method of Ranking." This consists simply of a set of cards, each card showing the foreman's name and occupation. The cards are then placed in order from the best to the worst by the immediate supervisors. For example, we had ten section foremen at one of our mines and they were ranked by the superintendent, general mine foreman and shift foremen individually from one to ten. This ranking was accomplished by laying all ten cards on the desk and having the superintendent select the top foreman in the group, and then the bottom foreman, removing each card as the individual was ranked until all of the cards were disposed of. This procedure was then repeated with the general mine foreman, and in the case of the shift foreman only the section foremen under their supervision. We were very careful to see that each man doing the ranking did it independently of the others without consultation.

Results Noted

After all of the foremen were ranked in their various classifications, they were tested over a period of four Sundays during April and May of 1954. Our test battery included a personality inventory and an intelligence test. A total of 70 men were tested, which included all foremen in our employ from the general mine foremen down. The scoring, analyzing and final "write-ups" were completed around the first week in June. The one encouraging factor in the testing of this pilot group was that the test results closely confirmed the rankers' opinions, which had been determined prior to the actual testing. Another favorable result was the convincing of most of the skeptics in management of the value of a testing program to be used in the selection of all future supervisory personnel. At this point we might mention that, in order to overcome a feeling of uneasiness among the foremen tested in the pilot group, they were informed that the tests were being given to establish standards for employment of new personnel and would have no effect on their employment status. As hereinbefore indicated, the group tested at this time represented the "cream of the crop," and, being aware of this situation, they rather welcomed the general idea, not only in that any newly employed supervisors should measure up to their standards but they took some pride in having themselves serve as the yardstick.

After the final analysis of this group we found that the average I.Q. was between 98 and 102, or, in other words, average as compared with the normal population. We also found that personality evaluation was just as important a factor as the rating of a supervisor's intelligence. Since personalities vary greatly from one individual to another, it is impossible to point out a certain set group of characteristics as being the only ones a top foreman will have, but it is possible to pick out personality traits which are considered desirable or undesirable for leaders to have.

Prospective Supervisors Tested

Since the original pilot group was tested, we have given tests to prospective supervisors as follows: 227 applicants with previous supervisory experience and 11 rank-and-file employes as prospects for possible supervisory training.

Of the above 238 men tested, only 130 met or surpassed the minimum intelligence standards established for prospective foremen, which is that they must have at least an average I.Q. based on norms for the normal population. All 11 of the rank-and-file men who were tested had well above the minimum intelligence requirements. Of these nine are now section foremen on salary, one is studying to take the State Mine Foreman's examination, and the other one is the maintenance foreman at one of our mines. Of the remaining 107 who met the standards, 59 were hired as foremen on a trial basis, and of this group 58 have been placed on salary and, according to the superintendents, are making satisfactory progress. Only one man of the selected group did not prove satisfactory. Also, two more of the qualifying group have been offered jobs and will probably start to work soon.

As a result of the recent addition of the above-mentioned supervisors, the average company I.Q. has been raised and is now between 103 and 107, or above average as compared to the normal population.

One side result that is worth mentioning here is—after a prospective foreman has spent the three or four hours it requires to file an application and take the tests, and is then employed, he starts on the job with a greater feeling of confidence in himself and security in his job.

1300 UMW Applicants Take Test

On the United Mine Worker employe part of the testing program we have had some very encouraging signs also. Over the past few years we have closed two mines, and at those mines we had a large number of good men. When we started taking applications for future employment, we felt that the logical thing to do was to consider these men first. Prior to contacting these men as to their desire to file an application, we had them rated by the management personnel who were in charge of those mines when they closed. Following this we went through the lists and sent cards to the top men, asking that they come in and file an application, if they so desired. We gave our first intelligence test to the United Mine Worker personnel during February 1955 and, to date, have tested approximately 1300 people, several hundred of whom were previously employed by us at the mines that were closed. We found the intelligence of this group of several hundred former employes to be above average, proving the fact that these men who were above average workers were also above average mentally. Since starting our Mechanical Comprehension Test back in September 1953, we have tested approximately 1400 people, with the end result that the average score made by this group was exactly the same as that made by more than 2000 applicants for mechanic's helper jobs in heavy industry.

Since starting its Mechanical Comprehension Test back in September 1953, Christopher Coal Co. has tested approximately 1400 people. At the present time tests are given to all applicants for employment, both United Mine Workers and supervisors

New Employment Procedure

At the present time tests are given to all applicants for employment, both United Mine Workers and supervisors. In fact, because of the testing, we have developed a completely new employment procedure, involving six steps.

(1) Initial contact interview with our employment manager, one of the superintendents, or some other company official. This is very brief and serves the purpose of weeding out the obvious undesirables before being referred to the Personnel Office for further processing.

(2) Filing the application. After some experience this has developed into the form of a guided interview.

(3) Testing. An explanation of each of the four tests will follow.

(4) Phone checks of information given on the application. The two main things we check here are the employment history for validity, and the former employer's opinion of and experience with the applicant. This step, of course, is usually eliminated when former employes are involved.

(5) Final interview with the superintendent.

(6) Physical examination.

In conjunction with this new employment procedure, it has also become necessary to revise our personnel forms and procedures.

Explanation of Tests

We have four tests—two in the supervisory battery and two in the United Mine Worker battery.

Before getting into an explanation of these tests, it might be well to discuss two words—"norms" and "percentiles," which will be used frequently throughout.

The results which are obtained from personnel testing are in terms of raw scores, which is generally the number of correct answers. By themselves the raw scores are not sufficiently meaningful. It is necessary to relate them to some index which does have meaning, one which will indicate an individual's performance compared to others. It is always necessary, therefore, to give the tests to a large unselected group of persons, and describe the performance of the group, using their distribution of scores as norms. (Tables of norms for comparison with various segments of the population are provided in the manuals for each test we use.) A convenient way of expressing scores is in terms of percentiles. Percentile is defined as the proportion of a group surpassed by a person making a certain score. His score is said to have percentile equivalent. For example, examinee John Doe made a raw score of 49 on a test, which, when translated to a meaningful percentile, indicated that he surpassed 60 percent (sixtieth percentile) of the population with which he was compared. The unusually able person whose score is high may fall in the ninety-ninth percentile, meaning that he has surpassed 99 out of 100 per-

sons who have taken the tests and with whom he was compared.

UMW Battery

In the United Mine Worker battery we have an intelligence test and a mechanical comprehensive test. The intelligence test we use is the "Revised Beta Examination." This test was selected because—first, it requires no reading ability; and, second, it is a fairly reliable, although not detailed, measure of intelligence. It is timed by sections, with practice sets and careful explanations before each section is administered. Actual testing time is 15 minutes, but with practice and explanation, it takes about 40 minutes to administer. After the applicant has completed the test, it takes about ten minutes to grade and find the Beta Score. A Beta Score is similar to an I.Q., except the range is not as broad. The process used to arrive at the Beta Score is a little too detailed for inclusion in this article but is completely covered in the manuals that come with the tests. The examinee's intelligence is classified as defective, inferior, below average, average, above average, superior, and very superior, based on comparison with established norms for the normal population.

The second test in this group is the "Bennett Test of Mechanical Comprehension." We felt that, due to the high degree of mechanization in the mines, a prospective employe should have at least a reasonable amount of mechanical comprehension. This test requires some reading ability, but since it is not timed, reading speed is not a factor. The examinee is required to answer 60 questions pertaining to mechanical situations or objects. It takes a person with normal reading ability from 30 to 45 minutes to complete. Scoring time is about three minutes. The raw scores are translated into percentiles, using norms based on scores made by applicants for mechanic's helper jobs in heavy industry.

Supervisory Battery

In the supervisory test battery we use the "California Short Form Test of Mental Maturity—Advanced Series (grade 9 to Adult)," for testing intelligence. This test was selected mainly because it is a fairly reliable measurement, less affected by chance; speed of reading is less of a factor and separate scores are given for several types of mental ability. The California Test is section timed, and, with explanation, it takes about 1½ to 1¾ hours to administer and about 15 minutes to score. The raw scores are translated into I.Q.'s and these are, in turn, translated into percentiles based on normal population norms.

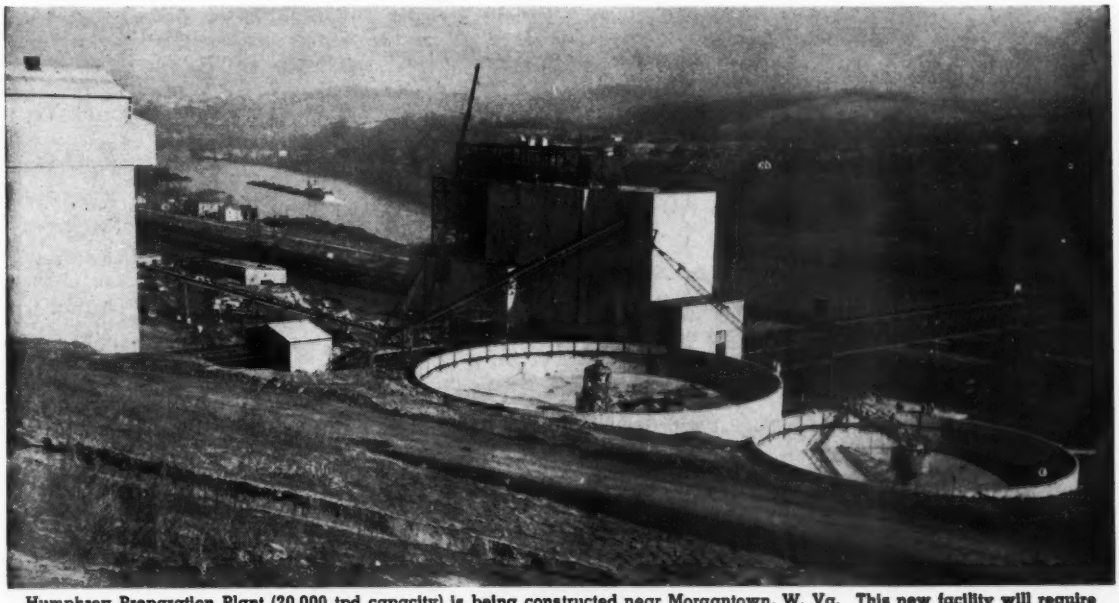
The second test in the supervisory battery is probably the most complicated of all our tests. It is known as the "Minnesota Multiphasic Personality Inventory," and requires special training to score and analyze. As mentioned before, we wanted to know what made a top foreman tick. Therefore, it was logical that a personality test be used. This particular test was chosen because it is the only self-test of personality that has very subtle built-in checks against faking and that has any pretension of reliability. There is a total of 390 questions pertaining to the examinee, about which we are always very careful to explain that he is to answer the questions truthfully, as he sees himself—not as he thinks others see him or as he wishes he were seen. Whether or not the individual is truthful in answering the questions is readily shown by the scores made on the faking devices. This inventory is untimed, and takes approximately 1 to 1½ hours to complete. Seventeen separate keys are used to obtain the raw scores for four validating scales, nine psychological scales and a just recently developed Foreman's Scale. These raw scores are weighted with the faking scores and then plotted on a special graph, thus giving us the profile from which the analysis is made. Scoring, profiling, analyzing and final write-up takes approximately one hour, more or less, per person, depending on the complexity of the profile. The Foreman's Scale mentioned was developed by a graduate student in the Psychology Department at West Virginia University, from the tests given the pilot group back in April and May of 1954, and possibly would not be applicable to any other coal mining company. This, of course, could only be determined by trial.

Top Foreman

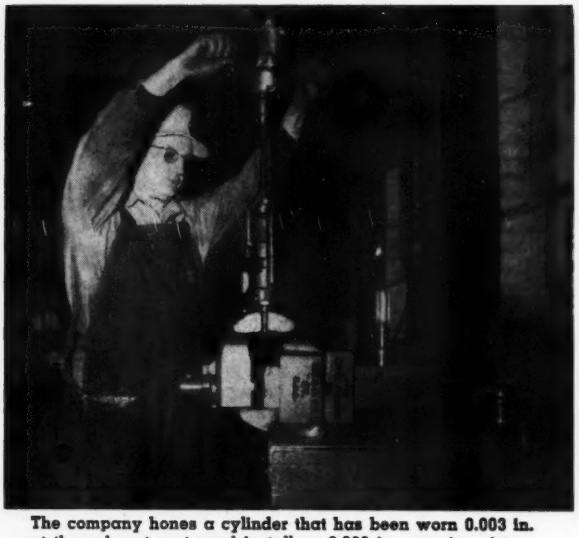
The following is a write-up for what we consider a good example of a top foreman:

"Somewhat unemotional. Tends toward being ambitious, vigorous and full of plans. Particular and orderly. Mildly sensitive. Showed very good reasoning ability. I.Q. Percentile Rank, Based on Norms for Normal Population, is 60. Foreman's Scale Score is 28."

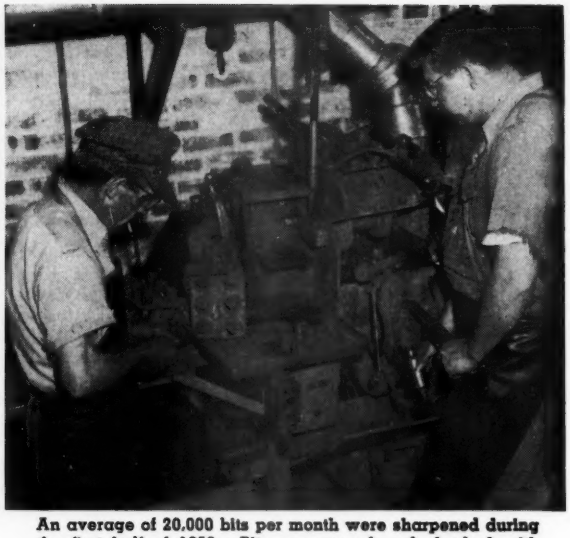
(Continued on page 121)



Humphrey Preparation Plant (20,000 tpd capacity) is being constructed near Morgantown, W. Va. This new facility will require employment of many underground and surface workers



The company hones a cylinder that has been worn 0.003 in. at the exhaust ports and installs a 0.002 in. oversize piston. The honed cylinder with oversize piston is practically a new machine



An average of 20,000 bits per month were sharpened during the first half of 1956. Bits are ground and checked with gauges so the angle on the insert is kept at 110°, and the bit crown at less than 10°

Drill, Bit and Steel Maintenance

Laid end to end, the blast holes drilled at this large gold producing mine would, in a year, reach nearly from Chicago to New York City. Here is an authoritative report by the mine superintendent that gives practical tips on drill, bit and steel care, provides a full description of the company's maintenance program, and lists cost figures

By C. N. KRAVIG
Mine Superintendent
Homestake Mining Co.

HOMESTAKE is currently milling over 4500 tons per day for seven days a week. All this tonnage is produced by drilling and blasting in stopes. The current drilling, including development drifts and raises, amounts to about 360,000 ft per month, or over 4,000,000 ft per year.

All stoping is done with jackhammers mounted on air feed legs in conjunction with 1⅜-in. detachable tungsten carbide bits and ⅞-in. hex. carbon drill steel. Most development drifting is done with the same equipment as is used in the stopes; this is especially true of the drifts where speed is essential. A few of the old timers still use 3½-in. drifters with 1-in. Q.O. drill steel and 1⅝-in. tungsten carbide bits; they have never used an air feed leg drill. Most of the raising is done with 3⅛-in. stopers (120-lb) in conjunction with 1-in. Q.O. drill steel and 1⅝-in. tungsten carbide bits, but as these stopers are wearing out and being discarded, we are changing to a medium weight stoper with ⅞-in. hex drill steel and 1⅝-in. tungsten carbide bits.

When we replaced all 3½-in. drifters with lightweight jackhammers mounted on air feed legs, there was some question concerning maintenance costs of the new equipment. We, therefore, started keeping a record of footage drilled, parts used and labor, and have a fairly complete record for 1952 to date. We keep cost data on a few individual drills, but generally we prefer average costs on various types of drills.

Drill Repair Shop

When the Ross shaft was put into operation some 20 years ago, it was so far from the mechanical department shops and drill repair shop that a new shop was constructed adjacent to the Ross headframe, and placed under the mine department supervision. The best mechanic available, who was a top-rated machinist, was placed in charge of the shop and is still functioning in that capacity. We feel that a top-grade machinist and mechanic is a most important factor in keeping rock drills in good drilling condititon. He has one full-time helper with him on drill repair maintenance and one full-time man on hose repair work. A fourth man works part time on drill

repair work and part time on hose repair, and some of the time outside the shop. The drill repair shop was set up near the shaft collar to give speedy service to the mine. At about the same time, a rule was issued that no repair work would be permitted underground, and that rule is still in effect.

When any drill needs maintenance, it is replaced with a spare unit and sent to the drill repair shop at the shaft collar. The cagers make regular cleanup stops every day. The drill is repaired the same day and is ready for use the next shift. When it is repaired, it is checked for wear and lubrication, and excessively worn parts are replaced even though still usable. Occasionally there are no replacement drills available, and in such cases the cagers bring the drill into the repair shop where it is given preference and is repaired immediately. The cager stops on his next trip to pick up and deliver the repaired unit to the station from which it came. A miner, motorman, or tool nipper comes to the shaft station for a replacement machine. When there are no replacement machines available, it means that broken or extra machines are lying around the mine and it is time for one of our periodic cleanup campaigns. Extra machines left about the mine as spares suffer more damage from rust than machines in use.

Each machine is stamped with a Homestake number and this number must be recorded on the miner's daily time slip along with footage drilled. In this way any machine which has been abused, or shows lack of lubrication, is immediately traced to the last users. This is a mighty deterrent to abuse of drills.

Equipment Used

Homestake has in service 248 lightweight jackhammers with air feed legs, and these machines drill over 3,000,000 ft a year. We also have in service twenty-six 3½-inch automatic drifters, fifty-one heavy (120-lb) 3⅛-in. stopers, six 3-in. drifters on a shaft sinking jumbo, and eight medium (90-lb) stopers. The jackhammers, 90-lb stopers, and 3-in. drifters have non-tappet construction, while the 3½-in. drifters and the 120-lb stopers have the anvil block construction. An average of nine machines per day are repaired for every working day of the year.

Air pressure is carried at 100 psi at the compressor.

Maintenance Less on Jackhammers

The table gives the costs of maintenance and repair of various types of rock drills being used.

After five years of using the jackhammers on feed legs, the maintenance is not as high as it was on the 3½-in. drifters.

A constant chuck blowing was lacking on the first jackhammers on a feed leg setup and inspection revealed cuttings doing much damage. Our drill doctor ground airways to produce chuck blowing and tests showed remarkable improvement in condition of internal parts. All machines were then converted. Now all drills are equipped with this important feature.

The life of a drill depends on the life of the cylinder. When a new cylinder is required, we dismantle the machine and salvage the usable parts.

In the past, a cylinder which was worn 0.004 in. to a clearance of 0.0065 at the exhaust ports was ready to be discarded. Recently we have changed this practice; we now hone a cylinder that has been worn 0.003 in. at the exhaust ports and install a 0.002 oversize piston. A wear of 0.003 in. at the exhaust ports shows less than 0.002 in. wear along the rest of the cylinder. The honed cylinder with 0.002 in. oversize piston is practically a new machine, and final discard comes after an additional 0.004 to 0.0045 cylinder wear. The cylinder has the same hardness through its entire wall so honing does not alter the wearing qualities. An AN-110 Sunnen cylinder grinder is used, and the honing requires about two hours of the drill doctor's time.

Pistons on our jackhammers last about 15 months, and by that time about ⅛ in. has been ground off the end which strikes the steel. The life of a piston is equal, or better, than when using heavy 3½-in. drifters and tappet construction.

The chuck bushing wears out faster in the air feed leg setup than on the column-mounted drifters because of less perfect alignment with the drill steel. We use 4¼-in. chuck bushings. We have found that chrome plated chucks give about twice the service of chucks which are not chrome plated.

Cites Examples of Service

Two new drills issued to a drift heading were used one year and a week when the 4270 ft of drift was completed. At the end of this period, one machine had drilled 74,862 ft at a maintenance and repair cost of $0.0084 per ft, and the other machine had drilled 72,603 ft, also at a cost of $0.0084 per ft. Both drills were in excellent condition at the completion of the drift. One of the drills showed

MAINTENANCE COSTS—MINE ROCK DRILLS—4 YEARS

(Last 6 Mos. 1952, Yrs. 1953, 1954, 1955 and First 6 Mos. 1956)

Class	Units Repaired	Footage Drilled	Parts	Labor	Total	Per Mach.	Per Ft Drilled
Drifters							
a.	510	1,172,625	$17,200.54	$1,458.37	$18,658.91	$36.59	$.0159
b.	382	72,413	883.93	512.53	1,396.46	3.66	.0193
c.	364	668,167	8,402.02	1,141.52	9,543.54	26.22	.0143
Total	1,256	1,913,205	$26,486.49	$3,112.42	$29,598.91	$23.57	$.0155
Stopers							
a.	838	641,731	$12,897.35	$1,360.35	$14,257.70	$17.01	$.0222
b.	175	110,708	1,968.33	282.12	2,250.45	12.86	.0203
c.	162	51,719	689.77	251.45	941.22	5.81	.0182
d.	119	121,185	2,983.73	407.47	3,391.20	28.50	.0280
Total	1,294	925,343	$18,539.18	$2,301.39	$20,840.57	$16.11	$.0225
Jackhammers							
a.	5,958	10,800,064	$93,665.91	$18,020.69	$111,686.60	$18.75	$.0103
b.	3,359	1,111,824	22,249.46	5,344.08	27,593.54	8.21	.0248
c.	676	420,862	10,672.69	1,148.60	11,821.29	17.49	.0281
d.	3	14,955	37.18	8.05	45.23	15.08	.0030
e.	258	202,332	2,703.36	742.80	3,446.16	13.36	.0170
f.	504	388,505	6,355.89	1,005.62	7,361.51	14.61	.0189
Total	10,758	12,938,542	$135,684.49	$26,269.84	$161,954.33	$15.05	$.0125
All Machines	13,308	15,777,090	$180,710.16	$31,683.65	$212,393.81	$15.96	$.0135

Homestake's drill repair shop was set up near the shaft collar to give speedy service to the mine

a cylinder wear (at exhaust ports) of 0.0007 in. after 60,248 ft of drilling, while the other showed 0.0013 in. wear after 60,492 ft of drilling. The difference in wear is probably due to the fact that one drill was used to drill the two-in. holes in the burn cut, while the rest of the holes were 1⅜ in. in diameter.

One jackhammer which has been in general stope use for five years has drilled over 120,000 ft, but the cylinder has not worn enough to be honed (0.003 in.). The wear at the exhaust ports after 120,388 ft of drilling was 0.0024 in., and the wear at the spacer end of the piston was 0.001 in.

Several jackhammers which have been in service in stopes for several years have had a cylinder honing and 0.002 in. oversize pistons installed. The footage at the time of honing was as follows:

Machine No.	Footage
1303	76,967
1304	46,709
1305	67,560
1309	55,831
1311	70,535

A drilling test was made of a machine which had just been honed, compared with a new drill of the same make and one machine nearly ready for honing, with the following results:

DRILLING SPEED IN MEDIUM TESTING GROUND

	Inches Per Minute	
New 2⅝" Jackhammer	21.56	
Honed 2⅝" Jackhammer—No. 1321	21.09	
Used 2⅝" Jackhammer—No. 1301	16.86	(cylinder wear 0.0024 in.)

The maintenance and repair of rock drills varies with the condition of drill steel shanks and the bit grinding procedure. Good practices in the bit grinding shop and drill steel shop have been great factors in maintaining an efficient drilling package.

20,000 Bits/Month Sharpened

The maintenance and repair of drill steel and the sharpening of drill bits are done in a separate shop from the rock drill repairs. This shop is under the mechanical department and is some distance from the shaft collar. Normally, drill steel is ordered only once a week, but an adequate stock of finished rods is carried to supply the needs of any foreman.

Each miner has his own rack of 12 tungsten-carbide bits with the name of the stope on the rack. These bits are brought out of the mine by the miners each shift, whether used or not. This procedure permits inspection of bits, and any excessive dulling or breaking or lost bits can be checked for any working place. The day shift bits are sharpened on night shift and vice versa. An average of 20,000 bits per month were sharpened during the first half of 1956. A bit with a 3/32-in. flat is considered fully dulled, but any bits slightly dulled are sharpened daily. The bits are ground and checked with gauges so the angle on the insert is kept at 110°, and the bit crown at less than 10°. The average grinding production is 25 bits per hour. This includes keeping a record of bits sharpened, bits discarded or missing from the racks, and new bits added. A record is kept of the reason for discarding a bit and is tabulated under headings such as stripped threads, inserts broken, etc. Missing bits are usually due to bits stuck in holes, and most of these are recovered on a magnet at the crushing plant. Miners have to return bits even though completely worn out. If the threads are unusable, the bits are wired to the rack. If any stope has an excess of missing bits, our test engineer visits the stope and watches procedures.

Maintenance of Drill Rods

A record is kept of all broken drill rods. Over 70 percent of broken rods failed five to eight in. below the collar in the metallurgical notch. Seventy percent of steel returned from the mine has worn threads. All drill steel returned from the mine is inspected for plugged water holes, worn threads, worn shanks, and bent steel. All bent steel is straightened, and all threads which appear unworn are tested with a go and no-go thread gauge. Shanks are inspected and tested with a new chuck bushing. Shanks and collars are forged on an IR-54 sharpener, and a 3/16-in. water hole is drilled on either a Toledo rod drill machine or a No. 3 Gisholt turret lathe. Production on the turret lathe is 12 rods per hour. Every second rod is checked with gauges. Threads are cut 0.002/-0.003 oversize to give a snug fit. Shanks are then faced to length, chamfered, and the water hole is countersunk. A No. 3 Gisholt turret lathe is used for this operation, and production is 35 rods per hour.

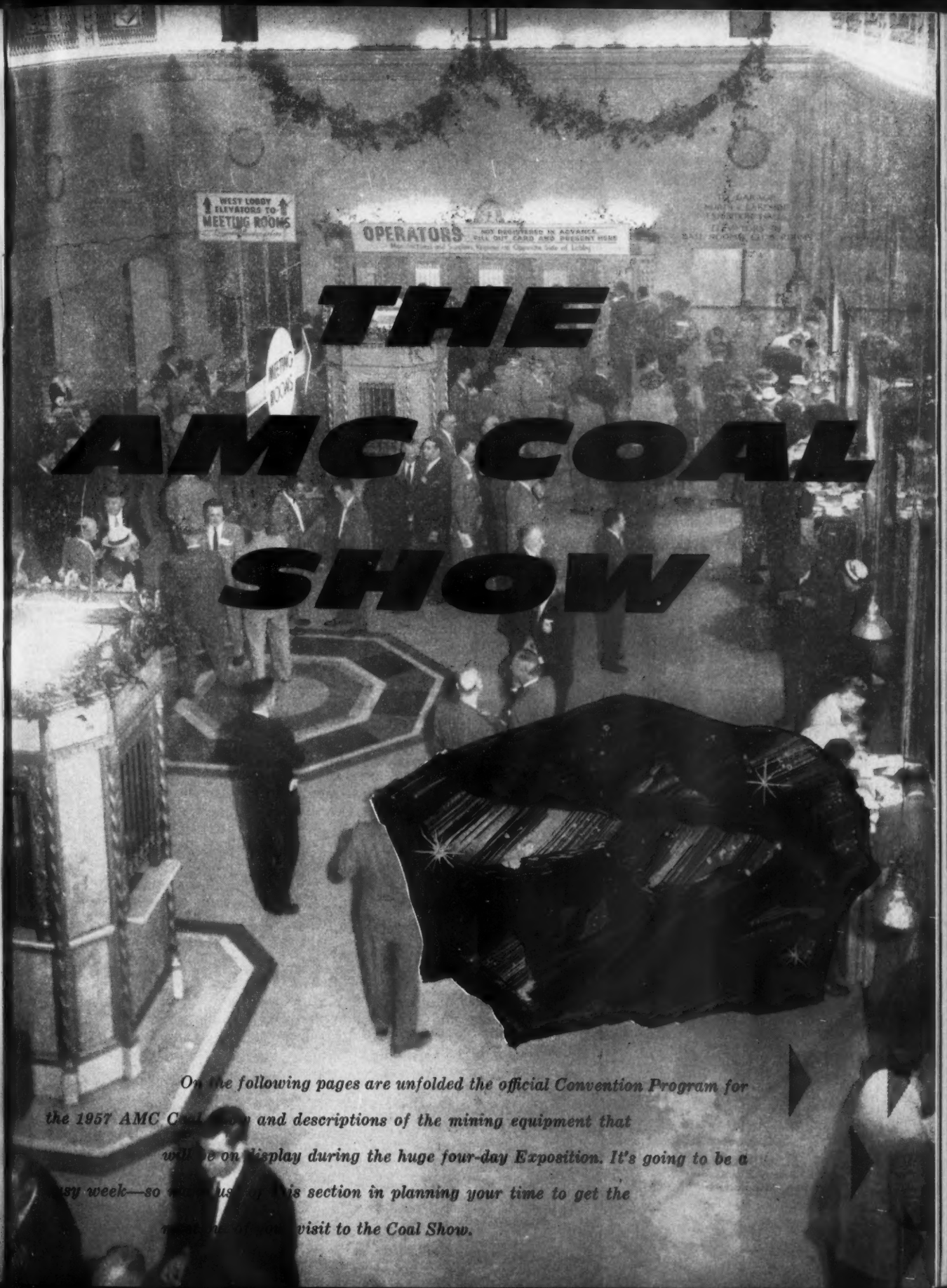
All rods are hardened in a Denver Fire Clay pyrometrically controlled natural gas-fired furnace. They are heated to 1600° F for 20 minutes then advanced 3½ in. for an overlap heat for an additional three to five minutes. The rods are then quenched in Houghton No. 2 quenching oil. This produces a hardness of 37 to 44 Rockwell C. One operator operates two furnaces.

All rods are tempered in an Ingersoll-Rand JDF electric draw furnace pyrometrically controlled at 550° for one hour. Houghton No. 275 draw-temp salt is used in this draw furnace. This temperature does not change the hardness as it is mainly a stress release and doubles the life of the shank and bit ends over rods which have not been tempered. As the rods are removed from the draw furnace, they are dipped in a hot water bath to remove the hardened salt from threads and water hole. All threads are buffed on a wire wheel to remove scale.

Some integral tungsten-carbide tipped drill steel is used in shaft sinking where the drill rods have to be removed each cycle, but because of the nipping problem, this type drill steel is not used in stoping.

The average consumption of ⅞-in. hex drill steel is about 160,000 lb per year. The cost per foot drilled for new bits, new drill steel, bit sharpening, and steel maintenance is $0.070.

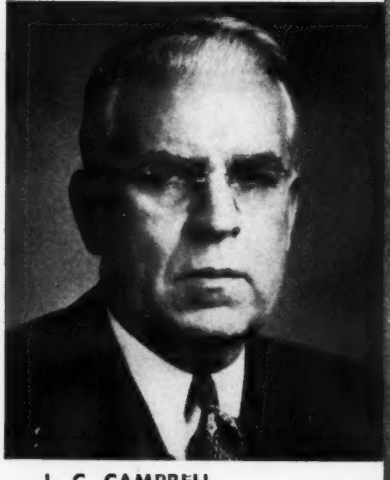
A proper balance between the size of drill steel, bit size, and rock drill is the first step in obtaining an efficient drilling package. A second, and very important part of maintaining high drilling efficiency, is that of good maintenance and repair of drills, bits, and drill rods. It is very important that the miner have an efficient drill available so he can get the maximum footage drilled in a shift.



THE AMC COAL SHOW

On the following pages are unfolded the official Convention Program for the 1957 AMC Coal Show and descriptions of the mining equipment that will be on display during the huge four-day Exposition. It's going to be a busy week—so use this section in planning your time to get the most out of your visit to the Coal Show.

A. R. MATTHEWS
Pres., Pittsburgh Consolidation Coal Co.
Chairman, Program Committee



L. C. CAMPBELL
Vice-Pres., Eastern Gas and Fuel Associates
Chairman, Coal Division

J. E. M. WILSON
Vice-Pres., Jeffrey Mfg. Co.
Chairman, Manufacturers Division

Theme of Largest Industry Meeting is "Coal Builds a Better America"

FROM May 13 to 16 Cleveland, Ohio, can be called the coal capital of the world, if numbers of coal mining people are any criterion. For during that week more than 10,000 mining men and ladies will descend on Cleveland from all over the world to attend the 1957 Coal Show of the American Mining Congress.

This year is one of tremendous importance to the industry—it is a year in which coal is out to prove that its big rebound from the production lows of 1954 was no accident and that coal's confidence in its own future is fully warranted.

The industry is acutely aware of the strong competition from other fuels—both fossil and nuclear—but it also realizes the important part which coal, with its basic position in the energy field, to its present high level, as well as coal's ability to supply the increasing energy demands that are coming.

In recent years many millions of dollars have been spent to improve coal's competitive position in the energy market by reducing production costs through increased mechanization. The results of some of these programs are only now becoming evident, and many of the papers to be presented during the four days of technical meetings will show what this huge outlay of capital has meant. At the same time, and to be considered in almost the same breath, the manufacturers of mining equipment have spent large sums of money in development and research programs, to come up with answers to the industry's increasing demand for machines that will do more jobs better and at lower cost. The immense indoor and outdoor exhibit areas of Cleveland's Public Auditorium will be taken over by equipment manufacturers and mine suppliers to exhibit these latest developments.

Recent Coal Shows have been drawing an increasing number of men from the fields of metal mining and industrial minerals production to study the methods and machines used by the coal industry in raising productivity to its present high level. As a service to the producers of nonmetallic minerals in attendance at the Coal Show, a special conference on industrial minerals, covering subjects of particular appeal to these men, has been arranged for Wednesday afternoon and Thursday morning. Complete details of this conference appear on page 86.

Well-Rounded Program Readied

Under the leadership of the Program Chairman, A. R. Matthews, president, Pittsburgh Consolidation Coal Co., a hard working committee has arranged a balanced and comprehensive program of technical papers for the several convention sessions. Leaders in their respective fields will report on the latest advances in deep and strip mining, coal preparation and problems of management and safety.

Opening session of the Convention on Monday, May 13, will deal with continuous mining and its current problems. Maintenance of continuous mining equipment and installation of power systems for such equipment will be stressed, as well as methods of supporting the roof behind continuous mining machines.

On Tuesday morning conventional mining and coal preparation will hold sway. At the session on conventional mining, haulage methods behind conventional equipment will be thoroughly discussed as will maintenance methods, mining in thin seams, and the use of a-c power underground. Coal preparation men will concentrate on water clarification, discussing three phases of the problem. Two papers will be devoted to recovering fine coal for its commercial value, one paper will discuss the clarification of washery water for reuse, and two papers will attack the problem from the point of view of eliminating stream pollution.

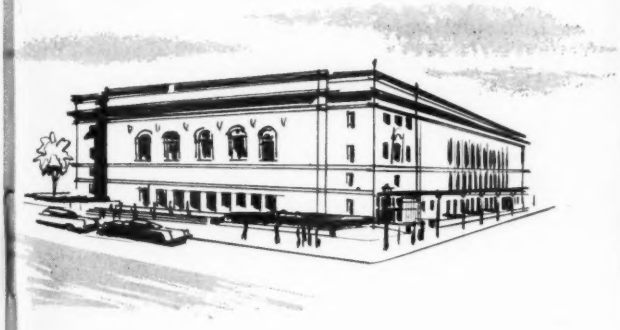
The first of two strip mining sessions will be held Tuesday afternoon, with emphasis on overburden blasting and handling. Two types of blasting agents will be described in separate papers, and the subject of overburden removal will be developed by three speakers who will describe the operation of large shovels, medium and small capacity equipment, and tractors and scrapers.

Conventional and strip mining will again occupy the attention of convention-goers Wednesday morning. At one session conveyor haulage, maintenance, construction and a-c power applications will be discussed, together with a paper on core drilling for air shafts and manway portals. Maintenance methods and portable power systems will occupy the attention of strip miners at the other Wednesday morning session.

In addition to the first of two industrial minerals sessions, (page 86), a management and a safety session will be held Wednesday afternoon, dealing with such topics as mine fire hazards, accident prevention, personnel testing and industrial engineering.

Thursday morning will see the second of the two industrial minerals sessions, the second of two sessions on continuous mining and the final session on coal preparation. A symposium on service haulage will be highlighted at the continuous mining session, along with two papers which will describe mining under difficult and favorable seam conditions. Coal preparation men will hear of anticipated trends in cleaning plant design and will consider coal drying, dust collection, fine coal cleaning and the use of two-deck tables.

Details of all these sessions are given in the final program on pages 82 to 85.



HOWARD I. YOUNG
Pres., American Zinc, Lead & Smelting Co.
President, American Mining Congress

JULIAN D. CONOVER
Executive Vice-President and Secretary
American Mining Congress

Largest Exposition Ever

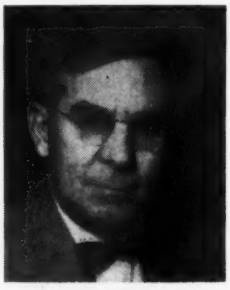
The 1957 AMC Coal Show promises to be the most impressive exposition of mining machinery ever staged in or out of this country. More than

SESSION CHAIRMEN

C. E. Walker
Vice-Pres.,
Jewell Ridge
Coal Corporation

George J. Clark
Pres., Reading
Anthracite Co

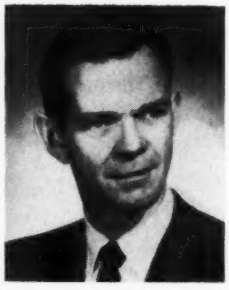
G. E. Sorensen
Pres.,
The Kemmerer
Coal Co.



S. A. Caperton
Pres.,
Slab Fork Coal Co.

W. J. Rude
Asst. Vice-Pres.,
Central Ohio
Coal Co.

J. W. MacDonald
Vice-Pres.,
Old Ben
Coal Corporation



W. D. Ingle
Pres.,
Ingle Coal Co.

A. R. Matthews
and
L. C. Campbell
Are Also Session
Chairmen

240 manufacturers of mining machinery and suppliers of tools and equipment for modern mining will have their very best foot forward at the huge machinery exhibition, which will cover more than four acres of net exhibit space.

Brief description of the exhibits appearing on pages 91 to 101 give only a hint of what is in store for mining men at the Coal Show. A wide variety of the tools so necessary for modern coal mining will be on display—from tiny electronic devices to huge trucks and power shovel components. Some exhibits will feature full-size machines to emphasize certain operating features. At others the center of attraction will be operating scale models. All exhibitors will demonstrate products or services vital to the successful operation of a coal mine or cleaning plant.

Many of the units on display will be introduced to the industry for the first time at Cleveland. In fact, some equipment manufacturers have made sure that no word leaks out about new units that will be shown. Trained engineers and technicians will man the exhibits. They will be happy to discuss the products on display and to answer questions about their application to any particular problem. Their presence makes this an unparalleled opportunity to see, hear and compare the merits of a wide variety of mining equipment.

Metal mining men and industrial mineral producers, who have been attending the Coal Show in increasing numbers, find that almost all of the equipment on display has direct application to their problems as well as coal's. Top management in the non-coal mining industry is finding that it just can't afford not to send key operating and management personnel to Cleveland for the express purpose of learning what is new with coal. There is no doubt about it, attendance at the Coal Show pays off in new ideas, renewed enthusiasm and lowered costs.

Entertainment Plans

The success of any good convention is due in no small part to the hours of fun and relaxation

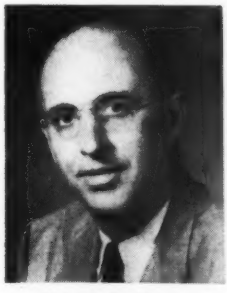
that accompany the time spent in technical discussion. The Coal Show has always been well known for its program of entertainment. The big event this year will be the Coal Miners Party on Wednesday evening, May 15, and a world of fun and good fellowship will be concentrated into this grand "official" evening of entertainment. To be held at two of the main hotels in Cleveland, there will be dinner, dancing, music and a scintillating floor show. All places are reserved, and demand for tickets in the past dictates that reservation be made early.

Monday, Tuesday and Thursday evenings will be left free for the many parties that are being scheduled by individual groups and companies, and for visiting with old friends and making new ones. Many Coal Show visitors will want to go "on the town" on one or another of these nights. For them, Cleveland has lots to offer. In addition, a short drive from downtown Cleveland will bring one to the Painesville Raceway where a full program of night harness racing will be in swing.

Special Ladies Program

Many of the ladies who are coming to the 1957 Coal Show have visited Cleveland before and are planning to take advantage of the city's fine shops and to revisit its points of interest. Those who are coming for the first time have a treat in store.

(Continued on page 87)



Richard D. Ketner

Alex Grant

Richard D. Ketner, manager of mining and nonferrous industries sales, General Electric Co., is Welcoming Committee Chairman for the Convention, and Alex Grant, general manager, Buckeye Coal Co., is Chairman of the Floor Committee.

PROGRAM COMMITTEE MEMBERS

I. N. Bayless
Union Pacific Coal Co.

R. K. Beacham
Ayrshire Collieries Corp.

C. R. Boll
Cummins Engine Co., Inc.

A. P. Boxley
Eastern Gas & Fuel Associates

N. T. Camicia
Island Creek Coal Co.

S. A. Caperton
Slab Fork Coal Co.

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Consulting Engineer
Charleston, W. Va.

E. R. Cooper
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C. C. Cornelius
Joanne Coal Co.

W. J. Crawford
Enos Coal Mining Co.

William Crawford
Powellton Coal Co.

E. E. Criswell
Compass Coal Co.

C. M. Donahue
Mine Safety Appliances Co.

W. Stuart Emmons
Hulburt Oil & Grease Co.

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Stonega Coke & Coal Co.

Theron G. Gerow
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Deister Concentrator Co.

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L. O. Millard
Link-Belt Co.

M. D. Millard
American Steel & Wire
Div., U.S. Steel Corp.

W. D. Moreman
Sanford-Day Iron Works, Inc.

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Stonefort Corp.

M. A. Shoffner
Freebrook Corp.

H. H. Smith
National Malleable & Steel Castings Co.

R. B. Warren
Goodyear Tire & Rubber Co.

W. L. Wearly
Joy Mfg. Co.

R. R. Williams, Jr.
Colorado Fuel & Iron Corp.

Robert E. Young
Harnischfeger Corp.

J. H. Sherrard, Jr.

W. C. Wright

Benjamin Tudor

R. D. Joseph

CONVENTION PROGRAM

E. M. Thomas

R. M. Johnson

John R. Palin

MONDAY—MAY 13

9:30 A. M.—Pre-Session Motion Picture

"Iron Ore from Cerro Bolivar"

10:00 A. M.—OPENING SESSION

CONTINUOUS MINING

Opening of Convention: A. R. Matthews, Pres., Pittsburgh Consolidation Coal Co.; National Chairman, Program Committee

●

Maintenance of Continuous Mining Equipment

J. H. Sherrard, Jr., Chief Engr., Johnstown Coal & Coke Co., Portage, Pa.

Design of a Power Installation for Continuous Operation

W. C. Wright, Supt. of Maint., Kaiser Steel Corp., Sunnyside, Utah

Roof Support Without Interrupting the Continuous Loading

Benjamin Tudor, Mining Engr., Clinchfield Coal Co., Clarksburg, W. Va.

Current Roof Support Practices With Continuous Mining

R. D. Joseph, Mining Eng. and E. M. Thomas, Mining Engr. Roof Control, U. S. Bureau of Mines, Washington, D. C.

TUESDAY—MAY 14

9:30 A. M.—Pre-Session Motion Picture

"The Story of Uranium"

●

10:00 A. M.—CONVENTIONAL MINING

Chairman: C. E. Walker, Vice-Pres., Jewell Ridge Coal Corp., Tazewell, Va.

Mechanical Mining in Thin Seams

R. M. Johnson, Mgr. Rockhouse Div., Island Creek Coal Co., Ragland, W. Va.

Two Modern Underground Rail Haulage Systems: Large Capacity Cars at Oakmont Mine

John R. Palin, Chief Engr., Harmar Coal Co., Library, Pa.

High Speed Operation at Powhatan Mine

C. S. "Pat" Winters, Supt., Powhatan Mining Co., Powhatan Point, Ohio

All-Belt Haulage and AC Power Underground

Courtney Quirey, Supt., Pittsburg & Midway Coal Mining Co., DeKoven, Ky.

Maintenance—A Tool For Increased Production

C. N. Van Houten, Supt. Maint., Tennessee Coal and Iron Div., U. S. Steel Corp., Fairfield, Ala.

C. S. Winters

Courtney Quirey

C. N. Van Houten

E. M. Robinson

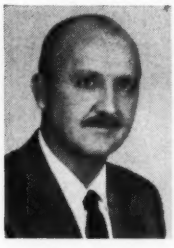
Wm. C. McCulloch

P. L. Richards

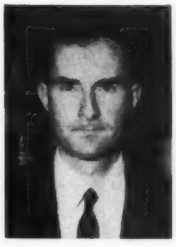
John C. Durfee

H. F. Hebley

Larry Cook


Fred Horne

C. C. Woolsey


D. W. Mogg

T. G. Gerow

F. E. Dougherty

9:30 A. M.—Pre-Session Motion Picture

"Water—Wealth or Worry for America"

10.00 A. M.—COAL PREPARATION

Chairman: George J. Clark, Pres., Reading Anthracite Co., Pottsville, Pa.

●

Water Clarification of Coal Cleaning Plants—Three Objectives

Recovering Fine Coal of Commercial Value

E. M. Robinson, Prep. Supt., Jeddo-Highland Coal Co., Jeddo, Pa.

Wm. C. McCulloch, Coal Prep. Mgr., Roberts and Schaefer Co., Chicago

Clarifying Washery Water For Re-Use

P. L. Richards, Mgr., Coal Prep. and John C. Durfee, Supt. Robena Plant, Coal Div., U. S. Steel Corp., Pittsburgh

Preventing Stream Pollution by Eliminating Slurry Waste

Henry F. Hebley, Research Consultant, Pittsburgh Consolidation Coal Co., Pittsburgh

Larry Cook, Exec. Vice-Pres., Ohio Reclamation Assn., Cadiz, Ohio

1:30 P. M. —Pre-Session Motion Picture

"A Diamond is Forever"

2:00 P. M.—STRIP MINING

Chairman: G. E. Sorensen, Pres., The Kemmerer Coal Co., Frontier, Wyo.

Drilling and Blasting Overburden: Two Papers

With Ammonium Nitrate Explosives

Fred Horne, Explosives Engr. Peabody Coal Co., Evansville, Ind.

With Liquid Oxygen and a New Type Carbon

C. C. Woolsey, Drilling and Shooting Supt., The Enos Coal Mining Co., Oakland City, Ind., and D. W. Mogg, Project Supv., Great Lakes Carbon Corp., Morton Grove, Ill.

Overburden Removal: Three Papers

Large Shovels in Heavy Cover

T. G. Gerow, Mining Consultant, Chicago

Operating Medium and Small Capacity Equipment

F. E. Dougherty, Vice-Pres. Operations, Tasa Coal Co., Pittsburgh

Tractors and Scrapers in Anthracite Stripping

Harry H. Hughes, Gen. Supt., J. Robert Bazley, Inc., Pottsville, Pa.

Harry H. Hughes

J. W. Bassett

R. E. Spoerl

W. C. Schott

C. C. Conway

D. C. Ridenour

L. E. Briscoe

B. E. Rector

R. L. Rectenwald

B. N. Carlson

Emil Sandeen

J. F. Whittaker

WEDNESDAY—MAY 15

9:30 A. M.—Pre-Session Motion Picture

"The Great Land—Alaska"

10:00 A. M.—CONVENTIONAL MINING

Chairman: S. A. Caperton, Pres., Slab Fork Coal Co., Slab Fork, W. Va.

Major Factors in Belt Conveyor Haulage

J. W. Bassett, Mining Engr., West Kentucky Coal Co., Madisonville, Ky.
Robert E. Spoerl, Chief Belting Engr., U. S. Rubber Co., Passaic, N. J.

A Shop School for Training Mine Mechanics

W. C. Schott, Vice-Pres., Stonega Coke & Coal Co., Big Stone Gap, Va.

Problems and Advantages of A-C Power for Face Machines

C. C. Conway, Elec. Engr., Clarkson Manufacturing Co., Nashville, Ill.

Core Drilling for Airshafts and Manway Portals

D. C. Ridenour, Chief Engr., Olga Coal Co., Coalwood, W. Va.

●

9:30 A. M.—Pre-Session Motion Picture

"The Manufacture of Wire Rope"

10:00 A. M.—STRIP MINING

Chairman: W. J. Rude, Asst. Vice-Pres., Central Ohio Coal Co., New York

Portable Power Systems for Strip Mines—Two Papers

L. E. Briscoe, Elec. Engr., Ayrshire Collieries Corp., Indianapolis
B. E. Rector, Mgr., Mining Engineering Dept., Westinghouse Electric Corp., Pittsburgh

An Engineering Approach to Rehabilitation of Large Castings

R. L. Rectenwald, Pres., Maintenance Engineering Corp., Pittsburgh

Rope Life Extended by Maintenance and Proper Use

B. N. Carlson, Chief Wire Rope Engr., American Steel & Wire Div., U. S. Steel Corp., New Haven, Conn.

Preventive Maintenance Based on 30 Years of Experience

Emil Sandeen, Mine Supt., Pittsburg & Midway Coal Mining Co., Hallowell, Kan.

●

1:30 P. M.—Pre-Session Motion Picture

"The Perfect Crime—Highway Accidents"

2:00 P. M.—MANAGEMENT & SAFETY

Chairman: L. C. Campbell, Vice-Pres., Eastern Gas & Fuel Associates; Chairman, Coal Div., American Mining Congress.

Mine Fire Hazards and Fire Fighting Equipment

J. F. Whittaker, Gen. Supt., Pittsburgh Coal Co., Library, Pa.

United Mine Workers' Role in Accident Prevention

C. B. Ferguson, Director, Safety Div., U. M. W. A., Washington, D. C.

(Continued on next page)

C. B. Ferguson

C. R. Nailler

G. W. Lockin

W. G. Kegel

G. L. George

M. M. O'Brien

Ray M. Biggs

William Laird

L. A. Updegraff

J. M. Bishop

A. P. Massman

E. R. McMillan

F. S. Ambrose

D. H. Davis

Selection of Coal Mine Personnel Through Testing

C. R. Nailler, Pres., Christopher Coal Co., Osage, W. Va.

A Method Study to Improve Face Costs

G. W. Lockin, Production Engr., Inland Steel Co., Wheelwright, Ky.

THURSDAY—MAY 16

9:30 A.M.—Pre-Session Motion Picture

"Twins on the Ohio"

●

10:00 A. M.—CONTINUOUS MINING

Chairman: J. W. MacDonald, Vice-Pres., Old Ben Coal Corp., Benton, Ill.

Service Haulage for Continuous Mining—A Symposium

A Belt Turning Device Conveys Around Curves

W. G. Kegel, Asst. Master Mechanic, Vesta-Shannopin Div., J. & L. Steel Corp., California, Pa.

A Bridge, Chain and Belt Conveyor Combination

Gordon L. Geoge, Supt., Wyatt Seanor Coal Co., Eskdale, W. Va.

Shuttle Cars, From Face to Intermediate Haulage

Michael M. O'Brien, Asst. Supt., Pocahontas Fuel Co., Pocahontas, Va.

Mining in Difficult and Favorable Seam Conditions

Ray M. Biggs, Elec. Engr., Viking Coal Corp., Terre Haute, Ind.

William Laird, Supt., Eastern Gas and Fuel Associates, Grant Town, W. Va.

●

9:30 A. M.—Pre-Session Motion Picture

"Movement is Life"

10:00 A. M.—COAL PREPARATION

Chairman: W. D. Ingle, Pres., Ingle Coal Co., Elberfeld, Ind.

Trends in Modern Cleaning Plant Design

Loy A. Updegraff, Project Engr., Bituminous Coal Research, Columbus, Ohio

Jack M. Bishop, Chief Chemist, Truax-Traer Coal Co., Ceredo, W. Va.

Coal Drying and Dust Collection

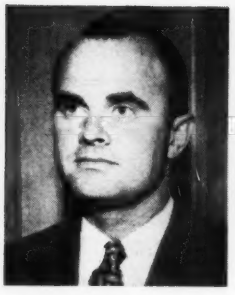
A. P. Massman, Coal Preparation Mgr., Peabody Coal Co., St. Louis, Mo.

Fine Coal Cleaning with the Feldspar Jig

E. R. McMillan, Mgr. Coal Operations, Northwestern Improvement Co., Seattle, Wash.

The Twin-Deck Suspension Type Coal Washing Table

F. S. Ambrose, Consulting Engr., Fairmont Machinery Co., Fairmont, W. Va. and D. H. Davis, Vice-Pres., Mathies Coal Co., Finleyville, Pa.



T. M. Ware

C. E. Wuerpel

Chairmen of Industrial Minerals Sessions

INDUSTRIAL MINERALS "ROUND TABLE"

For industrial minerals producers and other "hard rock" mining men attending the AMC Show two "round table" sessessions are scheduled. Experienced leaders will discuss technical subjects and operating problems, covering a wide range of raw material production and processing. The subjects selected are of broad interest to mineral producers and should stimulate a full exchange of operating ideas.

WEDNESDAY—MAY 15

1:30 P.M. Pre-Session Motion Picture—

"The Drama of Portland Cement"

2:00 P.M. Technical Session

Chairman: T. M. Ware, Administrative Vice-President, International Minerals and Chemical Corp., Chicago, Ill.

Changes in Drilling and Blasting Practice—Improved fragmentation was accomplished by increasing blast hole size and expanding the drill pattern. These changes were coupled with the use of self-propelled wagon drills, sectional drill steel and portable air compressors.

John C. Vonderau, Quarry Foreman, Michigan Limestone Div., U. S. Steel Corp., Hillsville, Pa.

Operations Research—Key to Effective Planning of Mining Operations

Speaker from Dunlop & Associates, Stamford, Conn.

Heavy Media Separation in Gravel Plants—The deleterious materials that prevent gravel in many deposits from passing specification tests are predominantly of low gravity and can thus be removed by heavy media separation. An increasing number of HMS plants are sucessfully competing with natural aggregates that must be transported some distance.

William Price, Engineering Manager, Keystone Div., Dravo Corp., Pittsburgh, Pa.

Kings Mountain Lithium Mining Operation—The author discusses the unusual characteristics of lithium and the sources of its ores, and describes all phases of his own operation pointing out the problems involved in selective open pit mining of a pegmatite deposit.

Neil Johnson, Plant Manager, Foote Minerals Co., Kings Mountain, N. C.

Utilization of Mined Out Areas—The idea of utilizing mined out areas underground for both defense and commercial purposes is explored. Its possibilities in furthering the defense effort and creating a new source of profit are intriguing.

Russel W. Hunt, President, Southwest Lime Co., Neosho, Mo.

THURSDAY—MAY 16

9:30 A.M. Pre-Session Motion Picture—

"The Open Road"

10:00 A.M. Technical Session

Chairman: C. E. Wuerpel, Vice-President & Technical Director, Marquette Cement Manufacturing Co., Chicago, Ill.

Preventive Maintenance for Steady Operation—The value of preventive maintenance is well established, although the degree to which it is used varies throughout industry. Here a successful system in use at a highly mechanized, trackless operation is described, giving full information as to facilities, procedures and controls.

F. W. Pfau, Maintenance Superintendent, International Salt Co., Detroit, Mich.

New Grinding Installation at Lone Star's Nazareth Plant—A new modern grinding plant uses eight 1000 hp mills for raw and finish grinding and is operated by only one man using centralized controls. The author also discusses overall layout and building structure.

C. C. Van Zandt, Vice-President, Lone Star Cement Co., New York, N. Y.

The Slope Conveyor System at Bell Mine—Two belt conveyors totaling 1388 ft were installed in an 18° slope to open up a new mining level. The permanent installation progressed with the drift advance so that the newly installed conveyor was used to remove the excavation muck.

Robert L. Smith, Mine Engineer, Warner Co., Bellefonte, Pa.

Production of High Early Strength Cement in Single Stage 3all Mills—The comparative merits of both short and long ball mills are presented along with field data from several plants using the two types of circuits.

C. A. Rowland, Supervisor of Grinding Mill Sales, Processing Machinery Dept., Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Hydraulic Transportation of Phosphate Ore—The mining and transportation of phosphate ore in Florida are described, pointing out the methods and equipment used to produce up to 1000 tph. Reasons are presented for using hydraulic transportation to move this material as far as five miles.

C. V. O. Hughes, Assistant Manager, Virginia-Carolina Chemical Co., Nichols, Fla.

See You in Cleveland!

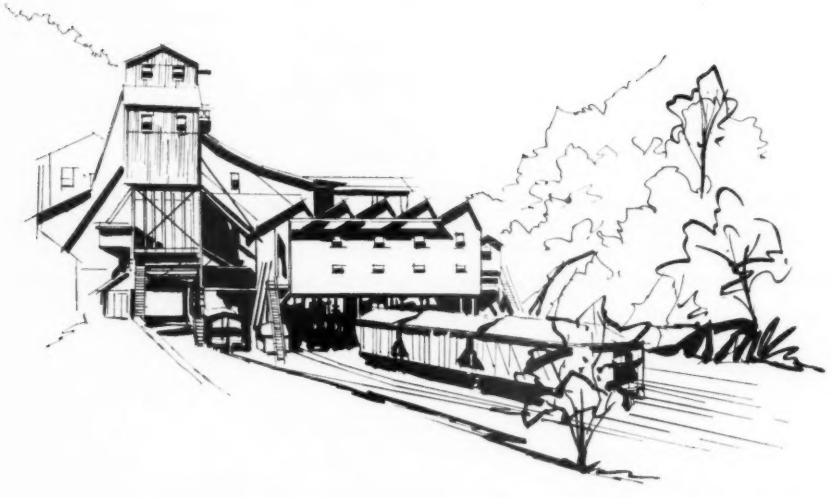
(Continued from page 81)

All ladies, of course, are welcome at the Convention sessions and the Exposition, and especially at the Coal Miners Party. In addition a series of special events has been planned for their particular entertainment.

At a Welcoming Luncheon on Monday at the Hotel Statler, the noted caricaturist, Lenn Redman, will be featured. On Tuesday, by popular request, another "nautical" party will be held aboard the "Carol Diane" to enjoy a sightseeing trip up the Cuyahoga River, one of the Great Lakes busiest ports. Thursday, following luncheon at the Hotel Cleveland, the ladies will be enter-

(Continued on page 90)

MANUFACTURERS DIVISION



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*Roberts & Schaefer Co.
Rock Products
*Roebling's Sons Corp., John A.
Rome Cable Corp.

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Vulcan Iron Works

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Western Machinery Co.
Western Precipitation Corp.
Western Rock Bit Mfg. Co.
*Westinghouse Electric Corp.
West Virginia Works, Connors Steel
Division, H. K. Porter Co., Inc.
White Motor Co.
Autocar Division
Winter Weiss Co.

(Continued from page 87)

tained by Jo Portaro, internationally famous hair stylist.

Tickets for the ladies events have been going fast, but every effort will be made to take care of all who wish to attend.

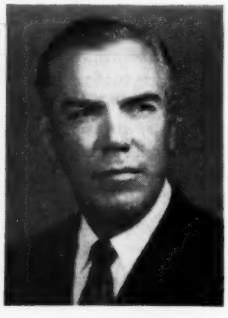
Plan Now To Be There

As mentioned earlier, a record crowd is expected for the 1957 Coal Show. The Housing Bureau has promised comfortable rooms for all, and requests for hotel accommodations, if they haven't already been made, should be sent to the Cleveland Housing Bureau, 511 Terminal Tower, Cleveland 13, Ohio. Those driving to Cleveland may wish to take advantage of the city's many fine motels. Arrangements may be made direct or through the Housing Bureau.

The 1957 AMC Coal Show offers an opportunity that should not be passed up to learn the latest in coal mining technology. Industry leaders will be on hand to detail progress over the past year and to indicate where we are headed in the future. Equipment manufacturers will be available to discuss any special problems facing individual operators and many will have just the answers that are needed. This is an opportunity that no one will want to miss. Make your plans now to attend.

Glenn B. Southward
Mechanization Engr.

Harry L. Moffett
Publicity Director



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EXHIBITORS

Here is a preview of the Exposition at Cleveland. More than 240 exhibits will occupy over 135,000 net square feet of space, both inside and outside the Public Auditorium. A study of the brief descriptions below, showing the products and services represented at this great exhibition, will make your visit to the Coal Show pay maximum dividends. Determine in advance which exhibits you want to study in detail and what problems you will discuss with factory engineers.

• ACF INDUSTRIES, INC.
AMERICAN CAR & FOUNDRY DIVISION

A large capacity eight-wheel rotary dump type mine car will be featured. In addition, an ACF four-wheel truck will be shown.

• ACME MACHINERY CO.

Will have three of their machines on display, all in operation. There will be a new four-wheel drive Jumbolter featuring tractor type steering; a self-propelled, four-wheel drive, air compressor with stoper jumbo arms and dust collection system, and a stationary air compressor.

• AEROQUIP CORP.

Will feature industrial hose for the mining industry. Both hand assembly and mechanical assembly of hose assemblies will be demonstrated. New products to be featured include very high pressure hose and truck air brake hose. Other products on display will be coal shooting hose and high, medium and low pressure hose.

• ALLEN-SHERMAN-HOFF PUMP CO., THE

Will feature interchangeable slurry pumps designed for pumping abrasive and/or corrosive fluid-solid mixtures. One pump, the Centriseal, requires no gland seal water, and the other, the Hydroseal, is totally lined for longer life with replaceable parts of rubber or synthetic substitutes.

• ALLIED STEEL & TRACTOR PRODUCTS, INC.

Display will feature Grip-Lug tractor grouser bars; Tuf-A-Brase alloy wear resistant plate; quarrying and mining tools; rock drill steel and carbide bits, and replaceable power shovel teeth.

• ALLIS-CHALMERS MANUFACTURING CO.

Exhibit will be representative of both the Industries Group and the Tractor Group. The Industries Group will exhibit a shaker screen and a line of electric motors for the mining industry. The Tractor Group will exhibit a four-cu yd tractor shovel, a motor grader, a motor scraper and a complete line of diesel engines.

• AMERICAN AIR FILTER CO., INC.

An operating model of the Roto-Clone hydro-static precipitator will be featured along with a Roto-Clone combined exhauster and dust separator. Also shown will be a high efficiency dry centrifugal dust collector.

• AMERICAN BRATTICE CLOTH CORP.

Will display jute brattice cloth for use in controlling underground ventilation. There will also be samples of Mine Vent and Neolon flexible ventilating tubing and ABC powder bags for transporting explosives underground on display.

• AMERICAN CABLE & HAZARD WIRE ROPE DIVISION AMERICAN CHAIN & CABLE CO., INC.

Samples of wire rope for use in such mining applications as draglines, shovel hoist lines and slusher ropes will be featured. Also shown will be an assortment of boom cable assemblies.

• AMERICAN CYANAMID CO.

The company's complete line of explosives and blasting accessories for the industry will be on display. Two new blasting agents, Cyamite and Accomite, will be shown for the first time at the Coal Show. A chart on current drilling, blasting, and excavation processes in coal stripping operations will be distributed.

• AMERICAN MINE SUPPLY CO.

A visual tension indicator for roof bolts will be featured. A machine will be used to give physical demonstrations of the indicators' operation.

• ANACONDA WIRE & CABLE CO.

Will use photographic displays to show the application of its line of trailing and power cables to the coal industry.

• ARMCO DRAINAGE & METAL PRODUCTS, INC.

Plans to show a wide variety of products, including sewer structures, tunnel liners, piling, liner plate bins and prefabricated steel buildings.

• ASHLAND OIL & REFINING CO.

Will feature its line of petroleum products for the coal mining industry. Samples of coal spray oil and industrial lubricants made and sold under the Ashland, Valvoline and Enarco brand names will be available.

• ATLAS POWDER CO.

Will introduce Atlas Granules, a new ammonium nitrate blasting agent. The importance of "oxygen balance" in ammonium nitrate blasting agents will be featured. Other displays will depict the construction and composition of electric blasting caps and the company's complete line of cartridge styles, blasting supplies and accessories.

• AUSTIN POWDER CO.

Two new concepts in machine bits for use in strip mining will be featured. Also on exhibit will be the company's line of detonating fuse and explosives.

• BALDWIN-LIMA-HAMILTON CORP. CONSTRUCTION EQUIPMENT DIVISION

Will have a photographic display showing various units of Lima equipment in operation.

• BARBER-GREENE CO.

Will show their new "Duo-Screen" for handling wet, sticky, hard to screen materials. Also featured will be the company's standardized belt conveyor line.

• BARRETT, HAENTJENS & CO.

Plan to exhibit Hazleton pumping equipment and accessories for the mining industry.

• BEARING SERVICE CO.

Will feature ball and roller bearings for the mining industry.

• BEMIS BRO. BAG CO.

Description not available.

• BETHLEHEM STEEL CO.

Exhibit will feature heavy duty mine track material and roof bolts. There will also be an exhibit of wire rope and slings for the industry. A wire rope making machine will be in operation.

• BIRD MACHINE CO.

A full size Bird-Humboldt oscillating centrifugal dryer will be in operation with all interior parts clearly visible. Also on display will be a Bird continuous centrifugal solid bowl coal filter, cut away to show interior components.

• BIXBY-ZIMMER ENGINEERING CO.

Various Bixby-Zimmer screens showing all B-Z rod shapes will be exhibited. Featured will be new developments of Iso-Rod and B-H loop screens.

• BLACKHAWK MANUFACTURING CO.

A new line of hydraulic hollow rams and attachments for pulling gears, shafts, sheaves, sprockets, pulleys and other tightly fitted parts will be exhibited. Also shown will be the company's complete line of hydraulic Porto-Power, including Porto-Power hydraulic rescue equipment, and hydraulic hand-jacks with capacities from 1½ through 100 tons.

• BOSTON WOVEN HOSE & RUBBER CO.

Will highlight its balanced belt construction, a method of belt manufacture which electronically equalizes ply tension. Another feature will be the company's Flameout Belting which will not support combustion.

• BOWDIL CO., THE

Will exhibit a complete line of coal cutting chains for all types of mining machines. A complete line of bits and cutter bars will also be on display.

• BRODERICK & BASCOM ROPE CO.

Will have on display its line of yellow strand Powersteel wire rope, flattened strand wire rope and standard strand Yellow Strand. A feature of the display will be miniature machines fabricating wire rope.

• BUCYRUS-ERIE CO.

Will feature a 32-cu yd dragline bucket made of Becoloy. In addition, a photographic display of the company's quarry and mining equipment will be shown.

• BURNDY CORP.

Temporary and permanent splices for trailing cables will be featured.

• BUTTNER WORKS, INC.

Will have a photographic display of the company's coal drying equipment and installations throughout the world. Dust collecting equipment will also be featured.

• **CARDOX CORP.**

Will have two exhibits, one inside and one outside. The Cardox Auger Miner will be demonstrated outside. At the indoor exhibit a standard Airdox compressor and a new semi-portable compressor will be shown. Also exhibited will be a general purpose drill for mounting on a truck or power wagon and a heavy duty horizontal drill for blast hole drilling.

• **CATERPILLAR TRACTOR CO.**

Will display a D-9 crawler tractor, motorized to show moving tracks and tilting bulldozer blade. A Traxcavator with a side dumping bucket attachment will also be shown. The bucket will be motorized to show operation. Rounding out the exhibit will be a coal hauler, industrial engine displays and tractor attachments.

• **CENTRIFUGAL & MECHANICAL INDUSTRIES, INC.**

Exhibit will include a field model of the company's new EB36-in. C-M-I continuous centrifugal dryer. The machine will be partially open so improvements can be seen.

• **CHICAGO PNEUMATIC TOOL CO.**

Electric and hydraulic roof bolting equipment will be featured. An all electric self-propelled roof bolting unit that is 28 in. high and can be adaptable to high or low coal will be on display. Other equipment will include the new CP Integral Sinker Airleg mounting a Wet Sinker and a hand-held CP Hydraulic Coal Drill.

• **CINCINNATI MINE MACHINERY CO., THE**

Will feature the completeness of its lines covering cutter chains, cutter bars, sprockets and cutter bits. Sample units of cutter chains and cutter bits will be displayed as will the newly developed holders for use with taper shank carbide tipped bits on continuous mining equipment.

• **CITIES SERVICE PETROLEUM, INC.**

Will feature Pacemaker T oil and its many uses in the coal industry. Also on display will be several samples of other oil used by the mining industry.

• **CLARK EQUIPMENT CO.**

Will have four tractor shovels on display. One, a six-cu yd machine is rated at 375 hp. There will also be a 240-hp tractor dozer exhibited.

• **CLARKSON MANUFACTURING CO.**

Will display their new design of the Marietta miner—a 440 volt, 3 phase, A-C continuous mining machine. Designed to operate in seams between six and seven ft thick, the machine is a double boring type with retractable arms and retractable cutter chains. Also on display will be a full line of Redbird Uni-flight conveyor chains.

• **CLEVELAND VIBRATOR CO., THE**

Display of its products will center on air and electrically operated vibrators. They will be in operation to illustrate the effect vibration plays in the movement of granular material. Highlighted will be a new air powered feeder which feeds material at a rate controllable by the supply of air to the unit.

• **COAL AGE**

Exhibit will illustrate the varied aspects of Coal Age's publishing service to management and operating officials in the coal mining industry.

• **COLLYER INSULATED WIRE CO.**

Plans to highlight samples of its line of cable designed for mining use.

• **COLORADO FUEL & IRON CORP., THE**
WICKWARE SPENCER STEEL DIVISION

Featured will be the company's line of wire rope, roof bolts, and Wisscoloy and Super-Tempered Precision Space Screens for the mining industry.

• **COMBUSTION ENGINEERING, INC.**
RAYMOND DIVISION

Will feature a plastic working model of the C-E Raymond flash drying system for fine coal. The model will demonstrate some improvements that have been made to eliminate degradation in the finished product and reduce dust loss from the dryer vent.

• **COMPTON, INC.**

Plans to exhibit a new type underground mining machine. The company reports it will be a high capacity machine with maximum flexibility for mining coal to a minimum height of 28 in. Also shown will be an innovation in their present line of coal recovery machines which is designed to increase the percentage of recoverable coal from an augered area.

• **CONNELLSVILLE MANUFACTURING & MINE SUPPLY CO.**

Exhibit will consist of a working model of a quick-dumping bottom-discharge skip. The skip will be operated to demonstrate the dumping cycle and its no-clog feature.

• **CONTINENTAL MOTORS CORP.**

Plans to show three of its line of 16 Red Seal cushion power diesels. One is a four-cylinder unit developing 34 hp at 2000 rpm; another, develops 59 hp at 2000 rpm and a third develops 72 hp at 1600 rpm.

• **COOKE-WILSON ELECTRIC SUPPLY CO.**

Replacement parts for mining machinery, featuring gears, pinions, worms, bevel gears and sprockets will be on display.

• **CUMMINS ENGINE CO., INC.**

Featured will be a new 375-hp, Vee-type eight-cylinder diesel engine. In addition, a 600-hp VT-12 and a 335-hp NRT-6 Cummins Turbodiesel engine will be exhibited along with a 300-hp torque converter.

• **D-A LUBRICANT CO., INC.**

The complete company line of heavy duty oils and lubricants for the mining industry will be on display. Factory representatives will be on hand to consult on lubrication problems.

• **DART TRUCK CO.**

Will feature its new bottom dump coal hauler powered by a 300-hp diesel engine and torque converter transmission. The hauler has a 61-cu yd capacity. Also on exhibit will be a Dart model 1917 one-ton truck powered by a Buda 27-hp gasoline engine and Fuller transmission. This truck was in active service until its retirement in 1950.

• **DAVEY COMPRESSOR CO.**

Plans to introduce to the mining industry its Model M8ALT Air Blast tractor-mounted rotary drill. The unit will include hydraulic leveling jacks, dust collecting system, and a 26-ft Kelly for a 20-ft pipe change. A conventional chassis-mounted drill will also be exhibited as will rotary portable air compressors and construction type air tools.

• **DEISTER CONCENTRATOR CO., THE**

Will exhibit for the first time its new Concenco "77" diagonal deck coal washing table. A two-deck table, it is suspended by cables with the head motion rigidly connected to the deck assembly. The company reports that the unit reduces impact to the building permitting smaller, lighter structures, and allows increased cleaning capacity per unit of floor space.

• **DENVER EQUIPMENT CO.**

Plans to exhibit coarse coal flotation in a simplified flowsheet designed to reduce equipment costs. In addition, a new nine-ft disc filter segment will be displayed together with water clarification units.

• **DETROIT DIESEL ENGINE DIVISION GENERAL MOTORS CORP.**

Will feature newly-introduced six-cylinder Series 71 and 100 Turbopower units of 236 and 375 hp respectively. Also new will be a diesel-electric set rated at 100 KW for continuous use and 125 KW for standby operation. Balance of the exhibit will include torque converters, Hydrostarter models and activated cutaway models showing the two-cycle operation of Detroit Diesel engines.

• **DIFFERENTIAL STEEL CAR CO.**

Will feature large capacity model cars for thin seam mining.

• **DODGE MANUFACTURING CORP.**

A new and different type of shaft coupling, called Paraflex, that the company reports will handle any kind of misalignment, will be demonstrated. Also to be shown for the first time is a simple method of mounting pillow block bearings on shafts. New developments in the line of Flexidyne dry fluid drives and couplings will be displayed.

• **DORR-OLIVER INCORPORATED**

Featured will be the Dorrco FluoSolids system for fine coal drying. A scale model of a complete drying system now under construction at a large preparation plant in the East will be on display. Also shown will be a complete line of Dorr-Oliver equipment including thickeners, filters, various types of classifiers and pumps.

• **DU PONT de NEMOURS & CO., INC., E. I.**

In an exhibit designed to salute the coal miner for his vital role in attaining present standard of living, the company will show several new products to be used in shooting overburden.

• **ELECTRIC STEEL FOUNDRY CO.**

Will have on display a tapered dragline bucket featuring a new 60-in. flat lip; Esco tested teeth; ArcEdge cutting edges of a new design, and dragline rigging and replacement parts. Plans are also being made to show for the first time a new four-yd all-cast shovel dipper.

• **ELECTRIC STORAGE BATTERY CO., THE EXIDE INDUSTRIAL DIVISION**

Featured will be a new motive battery development which has enabled the company to pack more storage battery power into a given space. Also shown will be Silvium, an alloy for battery grids.

• **ELLIOTT SERVICE CO., INC.**

Will feature different types of displays and bulletin boards for use in promoting various programs around the mines. They will also highlight their weekly and bi-monthly publication services for mine foremen and supervisors.

• **ELRECO CORP., THE**

Will feature overhead trolley line material, including section insulators, splicers, sliders, both regular and heavy duty, and trolley frogs, all smooth-underrun. There will also be various types of clamps and hangers on display as well as a complete line of fittings, aluminum to aluminum and aluminum to copper, for various cable sizes up to 1,600,000 CM.

• **ENSIGN ELECTRIC & MFG. CO.**

Will have on exhibition A-C and D-C starters, A-C and D-C mine power distribution boxes with mechanical trip and ground current limiters, centrifugal switches for conveyor belt protection, sequence operation, safety belt controls for stopping and starting a belt conveyor from any point on the belt line, the Ensign Ground-I-Cator, low resistance rail bonds and cable splicers.

• **ENTERPRISE WHEEL & CAR CORP.**

Plans to show an eight-wheel large capacity mine car equipped with rubber mounted automatic couplers and spring mounted running gear using roller bearings in the wheels.

• **EUCLID DIVISION GENERAL MOTORS CORP.**

Will exhibit three pieces of equipment. The 436 hp TC-12 crawler tractor will be shown with a 15-ft cable-controlled blade. The newest Euclid entry into the crawler business will also be exhibited—the 218 hp C-6 with hydraulic blade. Rounding out the exhibit will be a 360-hp 51-ton coal hauler.

• **FAIRMONT MACHINERY CO.**

A plastic model of the 1200-tph coal preparation plant being constructed for the Jamison Coal & Coke Co. will be featured. A plastic flowsheet will also be on exhibit showing the flow of coal, slurry and water through the plant.

• **FEDERAL-MOGUL SERVICE**

Description not available.

• **FEMCO, INC.**

Will have on exhibit components for communication systems for mine haulage, between levels and for cleaning plants. A permissible mine lighting system, built by the company, will be shown for the first time. In addition, control systems for indication or control of existing equipment such as fans, pumps and sub-stations, will also be featured.

• **FIRTH STERLING, INC.**

Exhibit will include the company's entire mining product line, including mining machine bits, roof bits, drill bits, finger bits, drill bit inserts, and mine percussion drilling grades.

• **FLETCHER & CO., J. H.**

Three new Fletcher roof drills will be shown, including a new model double drill, a special narrow drill for working beside boring-type miners, and a pair of drill units for mounting on ripper-type continuous mining machines. In addition, a standard model drill with all features will be displayed.

• **FLEXIBLE STEEL LACING CO.**

Will again feature belt fastening devices. Exhibited for the first time will be the company's new hinged belt fastener for use in joining extensible belts used behind continuous mining machines. It is a reversible joint using a nylon cable hinge pin. Rema self-vulcanizing rubber repair techniques will also be demonstrated and Flexco speed tools will be on display.

• **FLOOD CITY BRASS & ELECTRIC CO.**

Exhibit will consist of replacement parts for all types of mining machinery, trolley line material, pumps and

some electrical specialities. Also shown will be a new automatic pumping system.

• FUEL PROCESS CO.

A one-third scale operating model of the company's new type heavy media coal washer will be exhibited.

• FULTON BAG & COTTON MILLS

Description not available.

• GALION IRON WORKS & MFG. CO., THE

Display will consist of a model T-700 motor grader. Weighing better than 20 tons, it is powered by a 190-hp diesel engine and is being used for the construction and maintenance of haul roads in strip mines.

• GENERAL CABLE CORP.

Will feature a line of heavy duty mining cables.

• GENERAL ELECTRIC CO.

Electrical components for cost reduction in the coal mining industry will be featured. Motors and control equipment, load centers, circuit breakers, sub-stations, wire and cable, and mine lighting will be demonstrated. Akro featured will be a new 15-ton mine locomotive and a closed-circuit television system for remote inspection and control of conveyor lines. A two-way radio communication will be demonstrated and typical power systems for both open pit and underground mines will be shown.

• GENERAL SPLICE CORP.

Will feature a method of conveyor belt splicing. The company reports that a hammer is the only tool needed.

• GOODMAN MANUFACTURING CO.

Highlighting the Goodman exhibit will be two new pieces of equipment—the Type 300 continuous borer for coal seams from 4 to 5½ ft, and Ropex, an extensible belt conveyor for use behind any type loader or continuous mining machine. Other machines to be shown include a continuous borer for six to seven-ft coal seams, a shuttle car, a rubber tired universal cutter, a tread mounted loader, a rope belt conveyor, and a dust eliminating roof bolting drill. Also to be exhibited in the Goodman area is a Wilcox miner for coal seams as low as 2½ ft.

• GOODRICH INDUSTRIAL PRODUCTS CO., INC., B. F.

Will feature a small working model of its turnover conveyor belt system demonstrating the advantages of such a system. Belting samples will be on display as will samples of many kinds of hose used in the coal mining industry and a full size rotor and stator used in a Fagergren flotation machine.

• GOODYEAR TIRE & RUBBER CO., THE

Plans to use its booth as a hospitality area.

• GORMAN-RUPP CO., THE

Is going to present its line of self-priming centrifugal pumps in both active demonstration and formal display. A two-in. production model will be demonstrated in an open tank to show the self-priming feature. In addition, the display will include engine driven, self-priming "30 Series" and the new "80 Series" pumps on pneumatic mount for use in strip mine drainage applications.

• GOULD-NATIONAL BATTERIES, INC.

Will feature motive power batteries adapted to underground haulage applications. Various types of batteries will be on exhibit together with cross sections of cells to point up the various design features. Also featured will be the company's plus-performance data, instructions and helpful hints for improving battery maintenance and selection.

• GOYNE PUMP CO.

Two pumps will be displayed. One of these will be a high-head slurry disposal unit using a six-in. suction and six-in. discharge nozzles. The pump will generate 350 ft of head at 1200 rpm. The second pump will be a standard eight by 10-in. process pump for cleaning plant service.

• GULF OIL CORP.

Will feature the company's service to users of petroleum products. Emphasized will be a lithium base, multi-purpose grease.

• GUNDLACH MACHINE CO., T. J.
DIVISION OF J. M. J. INDUSTRIES, INC.

Will include a two-stage double adjustable crusher complete with 60-hp motor. The unit will be running under a no-load condition. In addition, the company will exhibit cone-shaped toothed rolls for crushing coke and clay materials.

• HAMILTON RUBBER MANUFACTURING CORP.

A pictorial display will show company products used by the coal mining industry.

• HARNISCHFEGER CORP.

Emphasis will be placed on a working mock-up of the control console and control panels of an electronically controlled excavator. Also to be displayed are cutaway and working models of the P & H Magnetorque units and a cutaway of the main drum assembly of a P & H 955A excavator. A gas driven welder will round out the exhibit.

• HENDRICK MANUFACTURING CO.

Will display samples of its many screens applicable to the mining industry. Included will be perforated screens, flanged lip screen, wedge slot and wedge wire screens, and open floor grating and stair treads.

• HENDRIX MANUFACTURING CO.

Will have on display one of their heavy-duty mining buckets, featuring a cast 14 percent manganese steel lip, chains and fittings.

• HERCULES MOTORS CORP.

Will feature a new line of interchangeable gasoline and diesel engines. Engines of the same cylinder size have the same mounting dimensions, allowing the customer to select either type of power according to equipment needs. Also on exhibit will be various models of the company's L-head gasoline engines and turbulence chamber type diesel engines.

• HERCULES POWDER CO.

King-size permissible cartridges, and blasting agents packed in steel containers will be included among the products on display. Examples of other Hercules explosive products for the coal industry will also be shown.

• HEWITT-ROBINS, INCORPORATED

Exhibit will feature conveyor idlers, speed reducers, Robintronic level indicators, optical comparators and a Eliptex vibrating screen.

• HEYL & PATTERSON, INC.

Will feature a three-dimensional display of a fine coal washing and water clarification circuit. A half-size operating fine coal jig will be demonstrated and cyclones with replaceable liners will be displayed. A fine coal centrifuge will also be on exhibition as will a demonstration model of the company's new fluid-bed dryer.

• HOLMES & BROS., INC., ROBERT

Will use two exhibit areas to display its products. Displayed outside will be a full sized model of the new Holmes Baughman fine coal dryer. Also to be shown will be

Holmes spirals for lowering coal of all sizes, car handling equipment for use under the tipple, laboratory crushers and pulverizers, hoisting equipment, and automatic skip and cage loading and dumping devices.

• HOUGH CO., THE FRANK G.

Will feature two rubber-tired front-end loading tractor shovels. Both models will feature four-wheel drive, power-shift transmissions, planetary final drives, power-transfer differentials, rear-wheel steering and four-wheel power brakes.

• I-T-E CIRCUIT BREAKER CO.

Description not available.

• INDUSTRIAL PHYSICS & ELECTRONICS CO.

Plans to feature its newly developed pneumatic weighing system which can be used to weigh and control belt conveyors to allow blending and ratioing of one product to another or of several products. The company's newly developed paging telephone for mine and plant communication will also be shown as will a tramp iron detector.

• INTERNATIONAL HARVESTER CO.

Exhibit will include a TD-18 crawler-mounted 4-in-1 unit; a Model 95 Payhauler, a 24-ton off-highway hauler with coal body; a TD-24 crawler-tractor with Rish coal blade; a Model 12 payloader, track-type, rear-engine, front-end shovel unit; and a cutaway model of a power unit.

• INTERSTATE EQUIPMENT DIVISION YARA ENGINEERING CORP.

Will feature its services to the mining industry.

• IRWIN FOUNDRY & MINE CAR CO.

Will exhibit one-quarter scale models of an eight-wheel mine car and an eight-wheel man-van car. There will also be a scale model of the company's patented four-wheel trucks on display. Also shown will be a working scale model of the Huwood-Irwin belt conveyor and metal mine props.

• JEFFREY MANUFACTURING CO., THE

Exhibit will highlight continuous mining. Two distinct systems of mining and transporting coal will be demonstrated. One system will consist of a Type 76-AM Colmol with a mining width of 9 ft 8 in. for seams ranging from 40 to 52 in. high, a 30-in. wide tire mounted Molveyor for delivery to a 30-in. wide self-propelled extensible belt conveyor. Another system will consist of a new Type 86-A Colmol with a mining width of 14 ft 7 in. for seams ranging from 28 to 44 in. arranged to discharge into a bridge conveyor for delivery to a pan conveyor. Two other Colmols will be displayed as will an Aerodyne fan and blowers, replacement parts and accessories. For the preparation plant operator, a pilot model Baum jig, electric vibrating feeders, a heavy duty slugger type crusher for reducing mine refuse, vibrating conveyors, a magnetic separator, chains, belt idlers, power transmission items and a car spotter will be exhibited.

• JONES & LAUGHLIN STEEL CORP.

Will present an exhibit of wire rope and wire rope slings. Visitors to the booth can also obtain information on JalKlamp, a J & L mechanical splice for wire rope.

• JOY MANUFACTURING CO.

Plans to feature latest designs in equipment for mechanized mining of both low and high seams. Ripper and full face types continuous miners will be on display with special emphasis being put on the new 5-tpm 5-CM Continuous Miner for medium-low seams. Among new conveyor systems to be displayed are the Joy Extensible Belts with 90° turns, Limberope Conveyors, and Ready-Span, a new pre-fabricated pipe truss conveyor frame. Also displayed will be the newest 15-ton high seam shuttle cars, low seam shuttle cars as well as high and low seam conventional loaders. Face drills, stopers, and the latest in roof bolting equipment will also be shown as well as universal cutting machines. Of special interest to many will be the new Microdyne Dust Collector.

• KAISER ALUMINUM & CHEMICAL SALES, INC.

Will feature its line of mining machine trailing cable. Two machines used to test training cables will also be shown.

• KANAWHA MANUFACTURING CO.

Description not available.

• KEENAN OIL CO.

Description not available.

• KELLY MANUFACTURING CO.

Display will feature mining machinery replacement parts for cutters, loaders, shuttle cars and trucks.

• KENNAMETAL INC.

Will exhibit a complete line of carbide mining tools and accessories. One special feature of the exhibit will be the new Kennametal U7T taper shank cutting bit which has been developed for use with boring type mining machines. In addition to design improvements on other cutter bits and drill bits, the exhibit will feature other applications of Kennametal cemented carbides such as Kenface, carbide hard facing material, metalworking tools and some of the many Kennametal wear applications.

• KENSINGTON STEEL DIVISION OF POOR & CO.

Will highlight the use of manganese steel castings in the coal industry.

• KLING BROS. ENGINEERING WORKS

A self-cleaning, motor-driven, rotating screen which will remove suspended solids from water will be featured. The unit can be used to remove coal fines from circulating water or to remove sand and debris from surface waters enabling the use of that water for cleaning plant processes.

• KOEHRING CO.

Display will feature the Koehring line of excavators on important stripping and mining operations.

• LABORATORY EQUIPMENT CORP.

Will feature two pieces of equipment for use in coal laboratories. One unit can be used for seven-minute sulphur analysis, giving results which are comparable to those obtained by the standard Eschka mixture method. A unit for ashing coal in ten minutes in an induction furnace will also be in operation. Visitors are invited to bring coal samples for analysis.

• LECCO MACHINERY & ENGINEERING CO.

An 8 by 16-ft long, double deck Lecco-Vib horizontal sizing and dewatering vibrating screen will be featured.

• LEE-NORSE CO.

Exhibit will feature a low coal Lee-Norse miner that is 26 in. high and capable of mining in seams as low as 30 in. A Model CM33X Lee-Norse miner with all the latest operating improvements will also be on display as will a low-type Mine Portal Bus.

• LeTOURNEAU-WESTINGHOUSE CO.

Highlight of the exhibit will be a new 30-ton off-road truck. This unit marks the company's initial entry into the truck field and represents a departure from conventional truck design in many features. Instead of springs,

the truck rides on four large air pistons. Axles have been eliminated and its wheel base is comparatively short. In addition, there will be four other rubber-tired units representing the company's line of open pit mining equipment. They are a 210-hp Tournatractor, an 18-cu yd Tournapull, a 190-hp torque converter power grader, and a Model D Tournapull with 11-ton rear dump.

• LE ROI DIVISION
WESTINGHOUSE AIR BRAKE CO.

Will have several new mining tools displayed. Included will be a new shock absorbing handle for use with Le Roi Sinker Drills and a new Airleg Sinker Rock Drill which has several new features, including a new ball-lock connection between drill and airleg. Roof bolting with Le Roi-Cleveland Vac-Nu-Matic stoper will be demonstrated.

• LESCHEN WIRE ROPE DIVISION
H. K. PORTER CO., INC.

On display will be numerous samples of the various types, sizes and constructions of Leschen wire rope and wire rope slings used in mining operations.

• LINCOLN ENGINEERING CO.

Will display for the first time to the coal industry a power drive centralized pump servicing an injector circuit to provide automatic lubrication on coal mining and processing equipment. Standard lubrication equipment from hydraulic type fittings up to and including power operated drum pumps will also be displayed.

• LINK-BELT CO.

Highlighted will be a scale model of a new design wash box, a vibrating screen, a Multi-Louvre dryer, and other mechanical components used by the coal industry.

• LONG CO., THE

Will feature the low height Model 88-C Pigloader and latest Long equipment for mobile conveyor continuous haulage mining. Also on display will be the Long Model 2355 Mobile Hydraulic Tractor Drill.

• LUDLOW-SAYLOR WIRE CLOTH CO.

Samples of abrasion-resistant Super-Loy and Ludloy woven wire screens and wire cloth, including a wide variety of square screen openings and long openings, will be on display. Also exhibited will be samples of finer meshes of wire cloth of various corrosion-resistant alloys and metals.

• LUKENS STEEL CO.

Display will emphasize the benefits derived from the application of Lukens Stainless-Clad and "T-1" steels in coal mines, preparation plants, and power plants. A lighted flow chart will point out areas where Lukens specialty steels can provide long life and maintenance-free operation.

• McLANAHAN & STONE CORP.

A completely new two-stage triple-roll crusher designed for present day needs of both large and small operators will be on display. The unit employs the single roll and double roll principles of reduction and will accept larger feed than conventional two-stage crushers.

• McLAUGHLIN MFG. CO., INC., THE

Drilling tools and accessories will highlight the exhibit. Included will be roof augers, coal augers, overburden augers, and bits and heads.

• McNALLY PITTSBURG MFG. CORP.

Theme of this exhibit will be "Coal preparation plants to make coal a better fuel." A world map with plastic facsimiles of plants built by McNally during the last three years will be a focal point of the exhibit.

• MACK TRUCKS, INC.

Three models of Mack off-highway trucks adaptable to the coal mining industry will be on display. There will be a six-wheeled tractor trailer unit of 60-ton capacity, a four-wheeled tractor with 45-ton trailer capacity, and a six-wheeled truck chassis with a 40-ton payload capacity. In addition, Mack will display its turbocharged Thermodyne diesel engine, its large eight-speed transmission used in off-highway chassis and its cam-and-plunger Power Divider differential.

• MACWHYTE CO.

Exhibit will include samples of the latest developments in wire rope for all equipment. Wire rope with swaged fitting ends and braided wire rope sling will be on display. The entire exhibit will describe and show wire rope in its various forms for use on and with all types of equipment.

• MANITOWAC ENGINEERING CORP.

Will use a photographic display to highlight equipment it manufactures for use in the mining industry.

• MARION POWER SHOVEL CO.

Will feature its complete line of stripping and coal loading machinery with special emphasis on the Marion Type 5760, a 60-cu yd stripping shovel.

• MARSH ENGINEERING CO., E. F.

Description not available.

• MARTINDALE ELECTRIC CO.

Plans to exhibit maintenance equipment and tools for electric motors and generators, such as mica undercutters, commutator grinders and stones. Also featured will be electrical testing instruments including ammeters, voltage testers, ohmeters, growlers, and field coil testers. Maintenance items will include portable electric blowers, industrial vacuum cleaners, wheel and gear pullers, electric etchers, and demagnetizers.

• MECHANIZATION, INC.

Will present the story of coal from the mining face through the preparation plant and into the furnaces of the final consumer. Coupled with this theme will be facts and figures showing editorial coverage, penetration of leadership and advertising growth of their three publications.

• MECKUM ENGINEERING, INC.

Will present the first showing of a Resonance Vibrating Screen. Of German manufacture, Meckum has been authorized to manufacture and sell the screen in this country. Among advantages claimed for it are: low power requirements; low maintenance, and no blind features.

• METALLURGICAL PRODUCTS DEPARTMENT
GENERAL ELECTRIC CO.

Theme of the exhibit will be "Service to the coal mining industry." A complete display of Carboloy mining tools including new type bits for continuous mining equipment will be featured. Also on display will be a large rotary drill bit equipped with carboloy inserts.

• MINE SAFETY APPLIANCES CO.

Will feature, along with the Edison electric cap lamp, the newly announced M-S-A fluorescent fixture for mine lighting systems. Minephones and Hoistphones, rock dusters and dust collectors for various mining applications will also be on display. In addition, there will be exhibited a complete line of personal protection equipment including breathing apparatus, self-rescuers, first aid supplies, hats, safety clothing and belts. A recently introduced line of Scotchlite brand reflective safety signs, tape and paint will also be shown.

• **MINING CONGRESS JOURNAL**

Monthly publication of the American Mining Congress invites the foot-weary visitor to "set and rest." Featured will be MCJ's service to the entire mining industry.

• **MINING MACHINE PARTS, INC.**

Display will be comprised of representative replacement parts, both mechanical and electrical, applicable to the coal mining industry.

• **MINING PROGRESS, INC.**

Description not available.

• **MINING & QUARRYING ROS-MAC PUBLISHING CO.**

Description not available.

• **MITCHELL INDUSTRIAL TIRE CO., INC.**

Will feature a special heavy duty mine tire designed to cut tire expense by eliminating downtime resulting from cuts, punctures, and blowouts.

• **MOORE CO., THE**

A cross section of a typical modern coal mine change room will be featured to demonstrate current practices in change room layout and design. Overhead storage of miner's clothing and personal effects, with full size locking rails, and actual clothes storage equipment will be featured.

• **MORRIS MACHINE WORKS**

Description not available.

• **MOUNTAIN STATE EQUIPMENT CO.**

Will exhibit a Manson Wet Rock Duster. This unit premixes the rock dust and water for delivery to a ¾-in. hose for application at high velocity.

• **MYERS-WHALEY CO., INC.**

Will use a photographic display to feature the Whaley Automat loading machine for both track mounted and crawler mounted applications.

• **NATIONAL ELECTRIC COIL CO.**

Will exhibit coils and motors wound with the latest insulating materials designed to run at higher temperatures and to resist oil, moisture, and other deteriorating agents that tend to cause premature failure of motors on coal mining equipment. Also shown will be procedures in rebuilding and modernizing mobile underground mining equipment.

• **NATIONAL MALLEABLE & STEEL CASTINGS CO.**

Automatic couplers, mine car rubber-cushioning devices and mine car trucks with friction dampening to control car bounce will be on display.

• **NATIONAL MINE SERVICE CO.**

Torkar A-C and D-C shuttle cars will be shown for the first time at any mining exhibit. Wheat automatic charging with electronically-controlled voltage regulation will be demonstrated with the new Wheat metal charging rack. Other demonstrations will include the new Hayden belt splicer for hand operation and a production splicer for mechanical splicing, Scandrua fire-resistant P.V.C. belting, Femco communication equipment, and Riken gas indicators. Also on display will be first-aid kits, safety equipment, drill steels, bits and augers, replacement coils for electrical control and motors, panel rebuilding, cable splicing and Koehler flame safety lamps.

• **NATIONAL SUPPLY CO., THE**

Will exhibit a rotating full-sized, cutaway model of its new heavy duty torque converter. The model is one of six basic sizes of National's single-stage torque converters which provide 17 power capacities between 100 and 1000 hp for matching with engines or electric motors of mining machinery and other industrial operations.

• **NEW DEPARTURE DIVISION GENERAL MOTORS CORP.**

Description not available.

• **NOLAN CO., THE**

Exhibit will consist of full size working models of a Nolan Hydraulic Porta-Feeder and automatic mine car loading station. Working scale models of a gear driven rotary car dumper and a trip feeder-retarder will also be displayed as will a full sized hydraulic life dolly which is designed to provide a method for transporting the Nolan Porta-Feeder from loading point to loading point.

• **NORDBERG MANUFACTURING CO.**

Featured in this exhibit will be a full-size Symons V-Screen designed for dewatering, desliming, dedusting and fine coal sizing. Also shown will be ¼-scale operating models of the Symons horizontal vibrating screen, a rod deck screen, and a vibrating bar grizzily.

• **OHIO BRASS CO.**

Will exhibit expansion shells for roof bolts, trolley line materials, safety and control equipment, rail bond materials, mine car couplers and locomotive current collection equipment. Featured will be a new cable fault locator, a new 3000-amp safety switch, a locomotive current collector, a new roof support expansion unit, and a hanger insulation tester. Other O-B products including valves and power sub-station lightning arrestors will also be on display.

• **OHIO CARBON CO., THE**

Will have a complete line of motor and generator brushes for the mining industry on display.

• **OKONITE CO., THE**

Will feature cables for all types of modern mining machinery applications. A group of samples of various cable connectors will also be on display.

• **OLIN MATHIESON CHEMICAL CORP. EXPLOSIVES DIVISION**

Featured will be a representative display of Olin dynamites and blasting caps. Also shown will be the Armstrong Airbreaker, a portable machine which utilizes compressed air to break coal in underground operations.

• **ORBAN CO., INC., KURT**

Will exhibit Union steel pit props which have been particularly designed to take initial roof load with a minimum amount of movement.

• **OSMOSE WOOD PRESERVING CO. OF AMERICA, INC.**

Exhibit will feature the Osmose pressure preservative treatment for mine timbers, ties and lumber. A scale model of an Osmose pressure plant will be on display as will timber samples treated in some of these plants.

• **OSTER MANUFACTURING CO., THE**

Will exhibit two models of portable pipe and bolt machines and a sewer cleaning machine. These units will be in operation for on the spot demonstrations.

• **PAGE ENGINEERING CO.**

Will feature its newly developed V-8 horizontal diesel engine for powering Page walking draglines. Also on display will be a completely fitted Page dragline bucket with reversible tooth points, double-wedge load sockets and twin-pin connecting links.

• **PARKER APPLIANCE CO.**

Exhibit will feature new Hoze-Lok fittings for use with rubber covered wire braid hose designed for hydraulic service.

• **PATTIN MANUFACTURING CO.**

Will show the various types and styles of roof bolts, plate washers and expansion shells it manufactures. Featured will be the D-2 expansion shell which is designed to eliminate the possibility of the wedge nut being pulled through the shell in soft roof.

• **PENN MACHINE CO.**

Exhibit will show a complete line of new replacement parts for coal mining equipment. Two pieces of production equipment will be in operation, manufacturing several replacement parts. Also shown will be the company's line of rail bonds.

• **PETERSON FILTERS & ENGINEERING CO.**

Description not available.

• **PICKARD INDUSTRIES, INC.**
CENTRAL MINE SUPPLY DIVISION

Will feature two types of ground fault protective devices and a wet rock dusting machine. One of the protective devices is small enough to be mounted inside most controller compartments on shuttle cars and mining machines, and the other has its own explosion-proof enclosure for attaching wherever convenient on machines lacking sufficient room for installation of the device in the controller compartment.

• **PITTSBURGH SCREW & BOLT CORP.**

Will have on display samples of the company's complete line of fasteners, both standard and special, which are produced for the mining and related industries. Roof bolting will be featured.

• **POST GLOVER ELECTRIC CO., THE**

Exhibit will include steel grid resistors for all types of mine locomotives, automatic transfer switches, reel motor contractors, manually operated "M" mercury switches, resistance arc welders, natural and forced convection electric heaters and grid type starters.

• **PRODUCTIVE EQUIPMENT CORP.**

Description not available.

• **PROTO TOOL CO.**
DIVISION OF PENDLETON TOOL INDUSTRIES, INC.

Display of hand tools will cover approximately 1200 different items. Socket, open end and box wrenches in a wide variety of sizes will be on display as will numerous type of pullers and power drive sockets.

• **PROX CO., INC., FRANK**

Will feature cutter chains for conventional bits and the company's one throwaway bit, chains, cutter bars and drive sprockets. A new line of chains, sprockets and bars for various continuous mining machines will also be on display.

• **PURE OIL CO., THE**

Exhibit will feature the company's line of industrial lubricants.

• **QUAKER RUBBER DIVISION**
H. K. PORTER CO., INC.

Featured will be the company's line of conveyor belts and industrial hose for use in the coal industry. A model conveyor belt will be in operation to show important features in conveyor handling of coal.

• **RADIANT LAMP CORP.**

Will have on display the newest in mercury vapor and incandescent inside reflector, hard glass, weatherproof lamps in standard and high voltage ranges.

• **RAYBESTOS-MANHATTAN, INC.**
MANHATTAN RUBBER DIVISION

Exhibit will feature the company's line of industrial rubber products with particular emphasis on conveyor belting and hose. Also to be featured is the Poly-V drive, a drive consisting of a new type belt with specially designed pulleys to mate with the ribs in the belt. Samples of safety trolley wire guard will also be exhibited.

• **REICH BROS. MFG. CO., INC.**

Will have a rotary blast hole drilling machine on display. Also shown will be a down-the-hole drill tool and the latest company development in down-the-hole drilling will be demonstrated.

• **RELIANCE ELECTRIC & ENGINEERING CO.**

Display will include adjustable speed motors, several models of A-C motors, a right-angle worm-gear A-C gearmotor, an A-C pump motor, and a Reeves vari-speed motodrive.

• **REPUBLIC STEEL CORP.**

Will have on display two roof bolting assemblies—a square head bolt with rigid expansion shell for low coal and a forged wedge bolt with rigid expansion shell for high coal. Also shown will be plastic pipe, welded chain and chain slings, stainless steel, high strength steel and alloy steel.

• **REYNOLDS METALS CO.**

Will exhibit samples of aluminum mine service pipe made by Reynolds and aluminum electrical conductor for use in primary and secondary distribution transmission lines.

• **ROBERTS & SCHAEFER CO.**

Will have a service booth for Coal show visitors. Secretarial service will be available and hot coffee will be served. Photographs of R & S plants and line drawings of equipment will be shown.

• **ROEBLING'S SONS CORP., JOHN A.**

Exhibit will be devoted to displaying wire rope and electrical wire and cable for industrial, mining and utility requirements.

• **ROME CABLE CORP.**

Will feature Neoprene sheath mining cables for mobile equipment and mine power distribution. Polyethlene insulated and sheathed mine power cables for high voltage distribution will also be shown.

• **RUST-OLEUM CORP.**

Exhibit will feature the use of Rust-Oleum rust preventive coatings in the mining industry. Factory engineers will be on hand to answer specific questions on rust preventive paints.

• **S K F INDUSTRIES, INC.**

Exhibit will include a new line of anti-friction bearings and pillow blocks along with Tyson tapered roller bearings. Highlighted will be an improved type spherical roller bearing, and a new and positive method for center lubrication of all spherical roller bearings will also be exhibited.

• **SALEM TOOL CO., THE**

Will use sound movies and slide projectors to show the company's line of vertical and horizontal auger drills in operations. Special emphasis will be placed on a new horizontal highwall auger drill for boring 8 and 9-in. holes with augers and drag bit or with augers and air operated Tricone heads. A complete display of augers and drill heads and auger drilling machines will round out the exhibit.

• **SANFORD-DAY IRON WORKS, INC.**

A large four-wheel automatic drop-bottom mine car with overlapping end features will be exhibited. The car will feature outside spring-mounted trucks and automatic couplers. Also on display will be examples of the company's wheel rebuilding program and a line of tipple hoists and car spotting hoists.

• **SCHRAMM, INC.**

Will have on display two models of Schramm Rotadrills, self-propelled rotary drills using compressed air for cutting evacuation. A 125 cfm self-propelled air compressor will be shown mounting a seven-ft steel rotary brush and 2⅝-in. drifter. This combination unit allows sweeping the coal surface in strip mines and drilling with the same machine.

• **SCHROEDER BROTHERS CORP.**

Will have on display hydraulic testing equipment, hydraulic tools, hydraulic filtration units, a self-propelled track-type utility truck, a hydraulic car spotter and automatic loading station equipment.

• **SHELL OIL CO.**

Plans to feature hydraulic fluids, motor oils and industrial greases.

• **SIKA CHEMICAL CORP.**

The Perfo roof bolting system will be featured with cutaway models and samples. The installation of Perfo bolts will be demonstrated as will quick-setting compounds for sealing pressure leaks.

• **SIMPLEX WIRE & CABLE CO.**

Description not available.

• **SINCLAIR REFINING CO.**

Will feature Sinclair lubricants used in the coal mining industry. On display will be a mechanized replica of coal haulage systems showing mechanical handling of coal from mine to tipple.

• **SOCONY MOBIL OIL CO., INC.**

Will feature the company's line of industrial lubricants.

• **SPENCER CHEMICAL CO.**

A blasting agent display will be used to show the properties of Spencer prilled ammonium nitrate as an explosive. Samples of ammonium nitrate will be available.

• **STANDARD DEVICES CO.**

Plans to introduce a new line of fireproof trolley taps and cable protectors. Also shown will be hydraulic hose fittings.

• **STANDARD OIL CO. (INDIANA)**

Exhibit will feature the company's facilities for serving the coal industry. Lubrication engineers will be on hand to discuss lubrication problems.

• **STANDARD OIL CO. (OHIO), THE**

Exhibit will promote the advantages of obtaining an industrial lubrication survey and will emphasize the company's line of industrial products.

• **STARDRILL-KEYSTONE CO.**

Will introduce a new development in all air rotary drilling for quarry, construction and coal stripping operations.

• **STEARNS MAGNETIC PRODUCTS**
A DIVISION OF INDIANA STEEL PRODUCTS CO.

Will have working models of a Stearns wet permanent magnetic drum separator and a Stearns suspended magnet on display.

• **TECHNICAL REPRODUCTION & SUPPLY CO.**

Description not available.

• **TEMPLETON, KENLY & CO.**

Display will feature high pressure one-way and two-way hydraulic rams, high pressure hydraulic pullers, hydraulic jacks, mining machine jacks, aluminum mechanical ratchet lowering jacks, and a wide variety of other type jacks for use in coal mines.

• **TEXAS CO., THE**

Will feature the use of its lubricants in the coal mining industry.

• **TIMKEN-DETROIT AXLE DIVISION**
ROCKWELL SPRING & AXLE CO.

Will display a mine car drive designed for shuttle cars, a cutaway planetary axle, an exploded planetary axle, a tandem axle, a front axle and heavy duty power brakes.

• **TIMKEN ROLLER BEARING CO., THE**

Tapered roller bearings and removable rock bits will be highlighted.

• **TOOL STEEL GEAR & PINION CO.**

Description not available.

• **TRABON ENGINEERING CORP.**

Description not available.

• **TWIN DISC CLUTCH CO.**

Will exhibit a three-stage motorized hydraulic torque converter equipped with a transparent housing, a new model single-stage truck converter with torque curve characteristics particularly adaptable to power shovel operation, and section models of heavy duty single and multiple plate wet and dry clutches.

• **TYLER CO., THE W. S.**

Will feature a Ty-Rock vibrating screen, a Ro-Tap testing sieve shaker and Tyler standard screen scale testing sieves along with a large selection of woven wire screens.

• **UNION WIRE ROPE CORP.**

Exhibit will feature the complete line of Tuffy slings, wire rope and sling fittings.

• **UNITED STATES RUBBER CO.**

Plastic pipe, conveyor belt, hose, packing, electrical tape and a complete range of power transmission belts will be on display. Included in the range of transmission belts will be the U. S. PowerGrip timing belts, rubber belts reinforced with fabric and steel wire.

• **UNITED STATES STEEL CORP.**

Will feature high strength steel, stainless steel, self-center belt conveyor aligners, T-1 steel, mine trackwork and grinding balls.

• **UNIVERSAL ENGINEERING CORP.**

Plan to feature a demonstration model of a wobbler feeder for feeding and scalping in a single operation. A model of a center feed reversible impactor will also be shown.

• **VAREL MFG. CO.**

Rotary rock bits in all popular mining sizes will be shown. Also on display will be diamond bits for use in mines and quarries.

• **VASCOLOY-RAMET CORP.**

Will exhibit a complete line of carbide coal mining tools.

Featured will be newly designed roof bits, continuous miner bits and auger bits. A suction type percussion roof bit will be shown along with a new pilot head for drilling overburden.

• VICTAULIC CO. OF AMERICA

Exhibit will feature the Victaulic method of piping. On display will be snap-joint couplings, portable grooving tools, and various types of Victaulic fittings. The Victaulic method of roll-grooving thin wall pipes will be demonstrated.

• WATT CAR & WHEEL CO.

Will use its exhibit area as a place for coal operators to stop and rest. Photographs and blueprints of the company's products will be available.

• WEATHERHEAD CO., THE

Will have a new hydraulic operated swaging machine in operation. Also on display will be a full line of Weatherhead flared and flareless brass and steel tube fittings, reusable hose ends, bulk hose and hose assemblies.

• WEDGE WIRE CORP.

Will show Wedge Wire screens in different profiles and metals. Featured will be the company's new Jumbo Wire and Migh-Tee bar screens designed for long life under severe operating conditions.

• WESTERN MACHINERY CO.

Will display its latest developments in coal treatment flowsheets with descriptive photos and drawings and product samples. A Wemco torque-flow solids pump will also be shown.

• WESTINGHOUSE ELECTRIC CORP.

Will feature mine type motors, motor controllers, Ignitron rectifiers, portable substations, power center, control center, switchhouse, battery chargers, gearing, and renewal parts.

• WEST VIRGINIA ARMATURE CO.

Plan to exhibit armature and field coils used in coal mining equipment and an undercutter for conditioning commutators.

• WEST VIRGINIA WORKS, CONNORS STEEL DIVISION H. K. PORTER CO., INC.

Exhibit will stress the economics of using Cone-Neck roof bolts. These are shipped assembled and ready for installation. Standard trackwork items will also be on display.

• WHITE DIESEL ENGINE DIVISION THE WHITE MOTOR CO.

Will display a model industrial diesel engine. Moulded plastic covers will enable the viewer to see internal construction.

• WHITE MOTOR CO., THE

Description not available.

• WHITMORE MANUFACTURING CO., THE

Will display its line of lubricants for use on open gears, dipper sticks, enclosed gear cases, cables and roller, ball and sleeve bearings.

• WHITNEY CHAIN CO.

Plans to exhibit its line of flight conveyor chain for all types of loaders and continuous miners. A complete line of American Standard precision steel power transmission and conveyor chains will also be shown.

• WILMOT ENGINEERING CO.

Exhibit will feature the Wilmot—OCC heavy media vessel. Also on display will be the company's line of chain and sprocket equipment.

• WINTER-WEISS CO., THE

An integral unit rotary drill for blast hole operations mounted on a Caterpillar D6 tractor with all drilling power furnished by the tractor engine through a series of power take-offs will be exhibited.

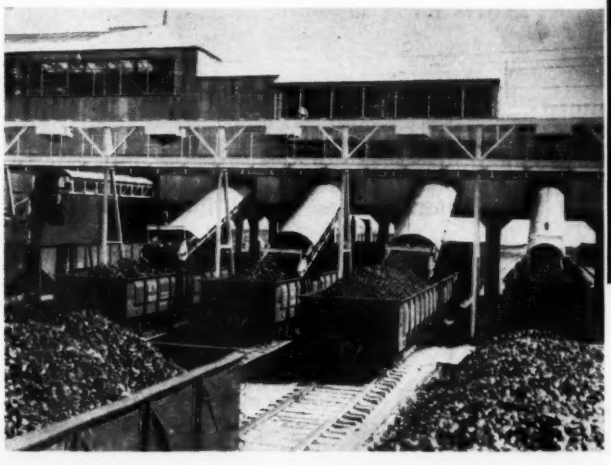
• WIRE ROPE CORPORATION OF AMERICA, INC.

Plans to exhibit mining machine cable and wire rope slings. Company personnel will demonstrate splicing procedure.

• YOUNGSTOWN SHEET & TUBE CO.

Description not available.

COAL BUILDS



A BETTER AMERICA!

BUCYRUS-ERIE WALKING DRAGLINE
moves overburden fast and far for Kentucky coal company

A Bucyrus-Erie 480-W's big capacity and long reach have materially improved stripping operations at the Riverview Coal Company, Inc., of Hartford, Kentucky, according to the owners.

Hilary Hurst, Riverview's secretary-treasurer, remarked, "At the rate the 480-W has moved dirt, we'll realize a profit on the investment in a relatively short time. After the machine's initial cost has been met, there will be plenty of coal left to be uncovered."

The machine's ability to handle large rocks has reduced the need for secondary blasting, according to company president and mine superintendent Kermit (Jim) Hurst.

This kind of profitable performance is the reason you will find Bucyrus-Erie walking draglines on high-volume earthmoving jobs all over the world. Features such as simple main machinery for year-after-year dependability . . . exclusive walking mechanism for smooth, sure moves . . . front-end design that combines strength with light weight — all have made Bucyrus-Eries outstanding performers for years.

The 480-W at the Riverview Coal Company moves up to 60 feet of overburden consisting of clay, sandstone and shale.

We will be pleased to provide you with full information on the model that's just right for your big-yardage jobs. Ten models are available with bucket capacities starting at 4 cubic yards.

124L57C

BUCYRUS ERIE

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BELT CONVEYORS
In Open Pit Mines

Outlining the development of conveyor haulage in open pit iron mines, this article stresses the need for detailed engineering studies to determine where conveyors will pay. Some of the new developments in belt and conveyor design are mentioned to indicate the wide latitude of service presently available from conveyor belts

By LLOYD S. CAMPBELL
Assistant General Superintendent
Eastern District—Oliver Iron Mining Division
U. S. Steel Corp.

IT was in 1868 that Lyster, an English engineer, developed the first endless belt conveyor. Since that date nearly 90 years ago, the principle of the conveyor has not changed but the refinements made over the years in the conveyor mechanism and the belt improvements have forced us to constantly revise our ideas as to the economic applications of conveyors.

A belt conveyor, like a locomotive or truck system, is merely a means of transporting materials from one place to another. As such, it is simply a tool to be used in the removal of mined material from a mine to a place where the material can be either stockpiled, processed, or placed in cars for further transport to its destination. The application of this tool separately or in combination with other transport in mining has been many and varied—some were proper and some improper.

Trend Toward Longer, Wider Belts

In the last 25 years since conveyors came into general use in the Lake Superior District for the purpose of removing iron ore from open pit mines, some 400,000,000 tons of iron ore have been carried on conveyor belts. This total does not include large portions of this same tonnage which have been transported on belts within processing plants or to stockpiles. We have through experience established the capabilities and limitations of belt transportation in open pit iron ore mining. The first belts installed were 24 and 30 in. wide, designed to run at 500 fpm and to transport about 600 tph. These belts had comparatively low tensile strength and forced the installation of multiple drive stations and numerous transfer points. The installations were, in most cases, very satisfactory but there was a tendency to overload the narrow belts. This overloading, together with the numerous drives and transfer points, made for high maintenance and operating costs.

Through the development of newer, stronger belts the trend is moving toward longer, wider belts carrying larger tonnages at reduced operating and maintenance costs.

Choice of Method

The method of transportation used for the removal of ores from open pit mines falls naturally into the four rather broad categories of rail haulage, truck haulage, conveyor haulage, and skip haulage. The categories are broad because frequently two or more transportation methods are used together. The choice of which method to install in a particular mine is quite naturally an economic one—that is, the method or combination of methods available at the lowest capital investment and the lowest operating cost consistent with good mining practice.

In the design of any type of mine transportation system, a primary consideration is the maximum grades upon which the system can operate. With rail haulage, that maximum is three percent; with trucks it is about ten percent; conveyors can be operated on grades up to 30 percent; and the inclined skips, of course, are limited only by the slopes of the open pit walls. The limiting grade of the truck operation is rather arbitrary. We have operated trucks on grades in excess of ten percent for short periods of time, and we have also installed conveyors on grades less than the ten percent; but, by and large, for most materials the limit is acceptable and our conveyor installations in mines are confined to the limits of ten to 30 percent grades.

All of us, as mine operators, are well aware of the fact that no two mines are alike and, consequently, an installation that works well in one mine does not necessarily work well in another. Also, as mining men, we are aware of the increasing labor costs and the increased capital required to develop and operate a mine. We have also found that increased engineering and budget planning have become very vital and have paid tremendous dividends. To illustrate this point, let us examine a study that was made about ten years ago to determine the means by which the ore from a new ore-body should be removed. This ore-body was the Hull-Nelson property connected to our Spruce open pit mine at Eveleth, Minn. The ore-body was well drilled so that we could accurately determine the outline and depth of the reserves. As a result of that study, we determined that an inclined drift should be driven 1400 ft in rock and a raise should be put up from the lower end of the drift through the ore-body to the surface, at which point a truck dumping pocket and a crushing and screening plant would be installed. It was planned that as mining progressed the surface installation would be lowered about every three years until the bottom of the ore-body was reached. The study indicated savings over the life of the reserves through installation of a conveyor and using trucks from the conveyor rather than the straight truck operation.

We have another mine, about five miles away from the Spruce mine, which we had been operating as a truck mine during the initial develop-

ment. It was decided, a few years ago, that we should make a similar study to determine whether it would be profitable to install a conveyor here also. This mine had smaller reserve and it occurred in four different orebodies connected by narrow channels of ore. The study indicated that cost of the conveyor and life of reserves did not warrant change in facilities.

Largest Conveyor Installation On Mesabi Range

The largest and perhaps the most interesting conveyor installation on the Mesabi Range is that operated by the M. A. Hanna Co., operating agents for various mining companies in the Lake Superior District. They had the problem, some years ago, of converting the South Agnew and Morton, former underground mines, into open pit mines. The South Agnew was covered with glacial drift ranging from 80 to 190 ft and averaged about 160 ft deep. The only dump area was about a mile away and limited in size. In order to deposit the estimated 15,000,000 cu yd of waste material, the dump would have to be about 150 ft above the ground level. In addition to these difficult operating conditions, the mines were very wet.

After months of study and investigation, it was decided to remove the overburden using an 1150B dragline to load into a portable screening plant which in turn would feed a 48-in. conveyor traveling 550 fpm. The screening plant eliminated boulders in excess of nine in. and the conveyor transported the balance of the material to the disposal dump where it was discharged over a traveling stacker.

Full-scale operation began June 1, 1948, and since that time the system has moved about 20,000,000 cu yd at a rate of about 600,000 cu yd per month. Operations are, of course, not continuous throughout the year.

Since the system was tailored to overcome the operating difficulties, the resulting cost per yard was less than could be accomplished using shovels and trucks.

These examples were mentioned to show that an engineering and accounting study is vital prior to the installation of any mining system and particularly so with conveyors because of the large original investment required.

New Developments Noted

Although it is impossible in this short article to fully cover all of the technical details of conveyor installations, some of the engineering aspects of conveyor design which are indications of the wide latitude of service available from belts should be mentioned.

LLOYD S. CAMPBELL graduated in 1936 from Michigan College of Mining & Technology. Since then he has been employed in various capacities by Oliver Iron Mining Division in Ironwood, Michigan, Eveleth and Virginia, Minnesota. With this background, he is able to present a first hand picture of the development of open pit conveyor haulage in the Lake Superior District.

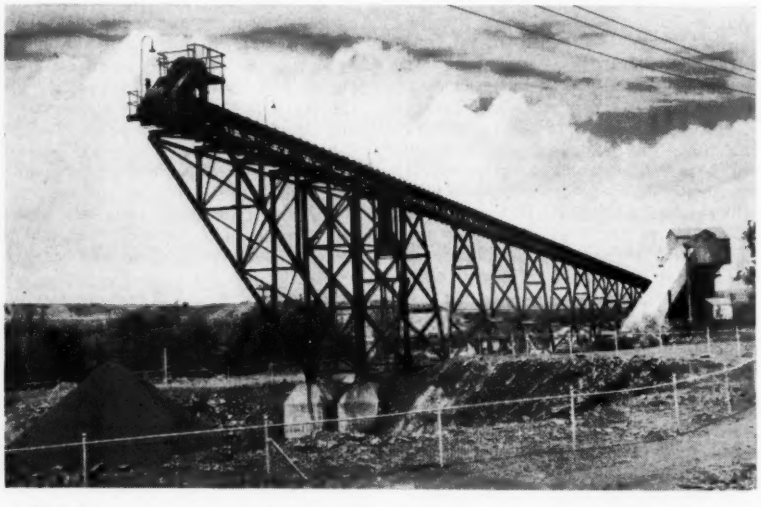
Belting itself has been the subject of involved research and experimental design. The belt is considered from the standpoint of carcass and cover—the carcass provides structural form and the cover protects the carcass from abrasion, moisture, environmental and mechanical damage.

Carcass design has progressed from a simple cotton duck fabric in one or several plies to a compound design using several materials in various forms. Cotton duck available in fabrics to 48 oz per yd, in belts to nine or more plies, in standard ply, stepped ply or envelope designs, still accounts for the major part of belt production throughout the country. The search for better troughing flexibility, higher resistance to mildew, and greater tensile strengths, has led to the use of synthetics in the form of ducks and cables. Rayons, nylon, orlon, and fiberglass are used either separately or in combination with cotton or each other to provide the desired characteristics. The search for high tensile carcasses was first given impetus by the use of steel cable belts which has expanded tremendously the application of long center belts. The cable construction idea has since been expanded to include cotton, rayon, nylon, orlon, and fiberglass cables and has resulted in the increasingly larger portion of the annual production from cable belts. An example of cord construction is the belt used in Oliver's Eastern District at the Spruce mine. This belt is made of rayon, nine cord plies, 1531-ft centers and operates on a grade of 25.6 percent. It was designed for a total tensile strength of 260,000 lbs with a safety factor of 5.8, carrying an average of about 750 tph of mine run, screened ore to the loading pocket.

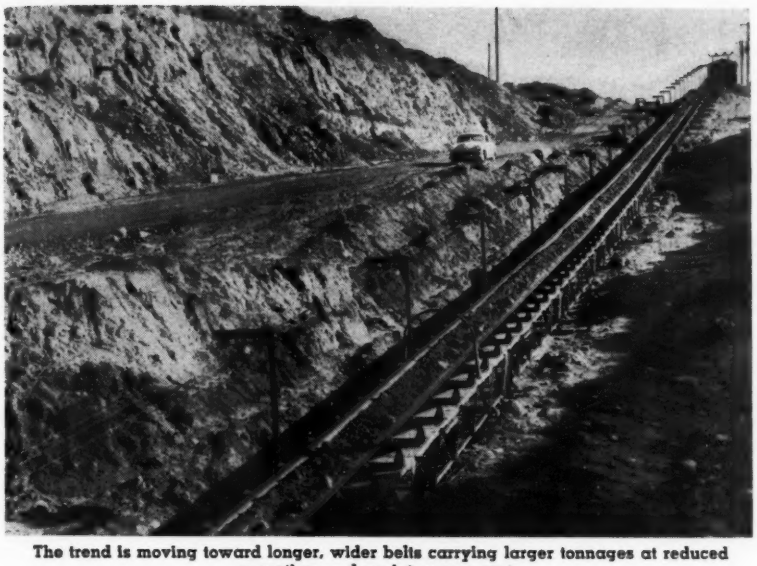
Belt covers have been developed in

First installation of its kind on the Mesabi range

Stacker conveyor, surge bin and loading pocket of conveyor belt system installed at an open pit iron ore mine near Eveleth, Minn. Rising out of the ground on the right is the housing of the main conveyor belt which travels ¼ mile hauling the ore to the loading pocket. Ore is dumped from the belt into bins in the pocket for loading into railroad cars.



Stacker conveyor and surge bin operate when normal loading is disrupted to bring ore from the main conveyor belt to the surge bin at left, thus preventing a possible shut-down of mining operations in the pit. Ore stored in the surge crater can be dumped onto the main conveyor belt below and transported to the pocket for loading into railroad cars.



The trend is moving toward longer, wider belts carrying larger tonnages at reduced operating and maintenance costs

several grades of natural rubber and in neoprenes and other synthetics to provide a moisture tight damage resistant envelope for the carcass. Special designs for heat, oil, and shock resistance are now available. Shock pads of soft rubber under the harder cover and step pads to provide greater thickness for wear can be utilized to reduce belt wear and maintenance.

Surface covers for the belts also offer some interesting possibilities. Some belts with a chevron finished cover are used to dewater materials while the inverted chevron is sometimes used to add another degree or two to the maximum grade that a belt can elevate certain materials.

The driving and carrying mechanisms also have come in for a great deal of improvement. The self-contained driving pulleys with the motor and reduction gears contained by the head pulley shell may help in some applications and the use of fluid coupling devices and magnetic clutches may reduce capital investment and lower maintenance.

A new approach to idler design that may prove interesting is the "Limberoller" as developed by the Joy people. The cable belt is also being watched with avid interest by industry because of its possible use in remote locations, its cheaper roadway, longer flights and lessened repair costs.

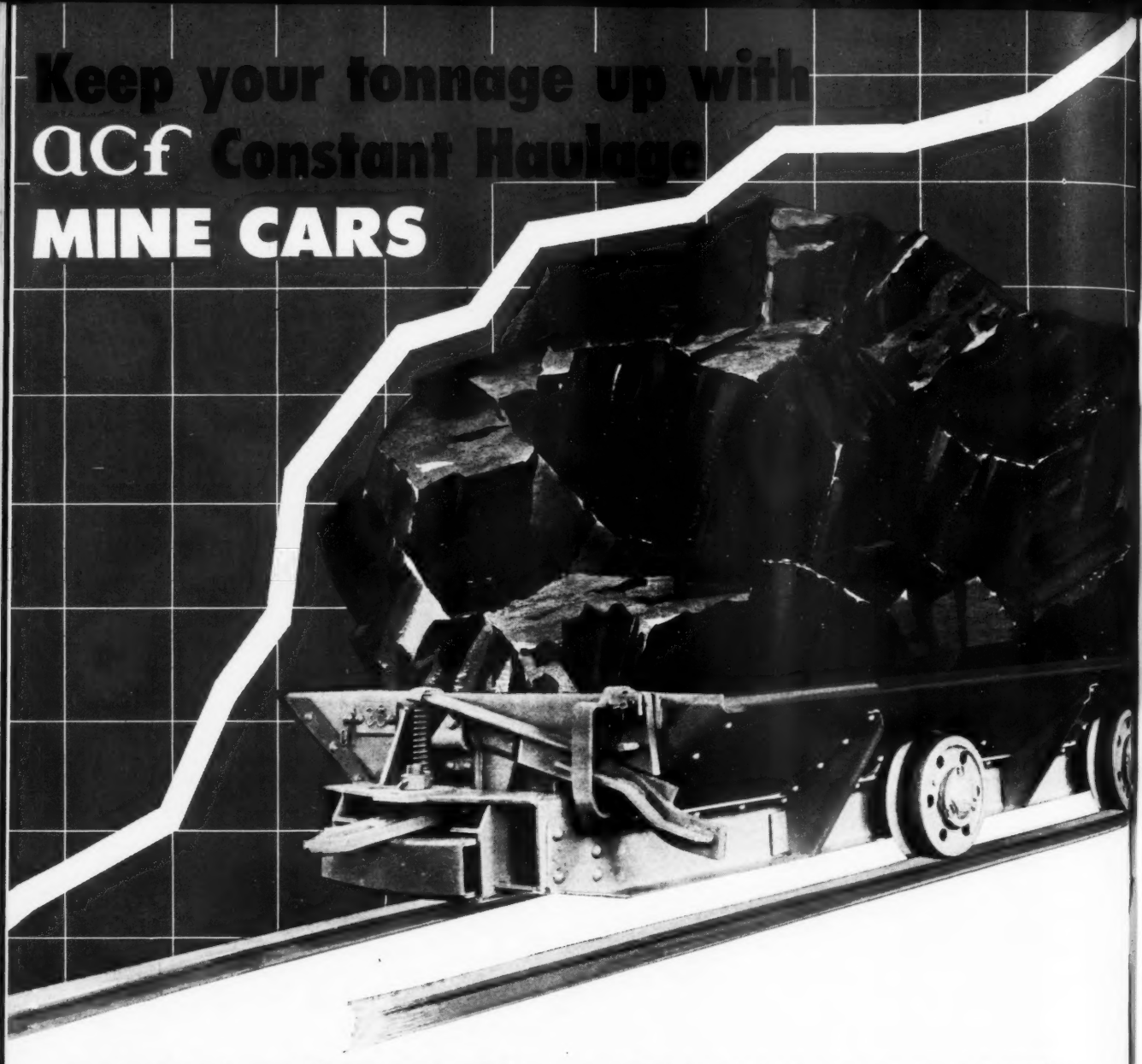
Offer Great Possibilities

These new developments in construction of the conveyors, and the new materials being utilized in belts are rapidly overcoming some of the previous objections to conveyor belt installation. We know that the improvements will continue and that belt conveyors will find many more applications in open pit mining. Conveyor belts are being constructed with capacities ranging from a few tons to 6000 tph or more per belt. Belt widths of 60 to 72 in. are common, and speeds of 800 fpm are being used in some of these wide belts. With the new developments, greater capacities, and longer lifts, cheaper operational and maintenance costs are a certainty.

In closing it should be re-emphasized that properly engineered, properly installed conveyor belt installations offer tremendous possibilities in open pit mines. On the other hand, improperly designed and installed conveyors can be a costly source of trouble.

A dragline and belt conveyor system is used at this open pit mine on Minnesota's western Mesabi range. Waste material is removed by the dragline and carried by conveyor to a dumping area several miles away

Keep your tonnage up with acf Constant Haulage MINE CARS



Some haulage systems can idle equipment worth thousands of dollars every time they need repairs. But not **acf** Mine Cars. When one car needs repairs you just shunt it aside, stopping the trip for only one or two minutes.

Then the rest of the trip keeps rolling, loading, hauling, unloading as fast as a ton a second. Because they keep haulage delays to the absolute minimum, **acf** Constant Haulage Mine Cars keep productivity up and cost-per-ton down. Your own men can make repairs without difficulty.

And that's not all. Mine cars give you flexibility: as you advance the face, just move or add trackage, without stopping production. And *two-way* payloads: the cars that haul coal out can carry men and supplies back in.

Mine operators have recorded actual cost and production figures that show the advantages of **acf** Constant Haulage Mine Car Systems. For full information, just ask your **acf** representative. Write, wire, or phone any **acf** office.

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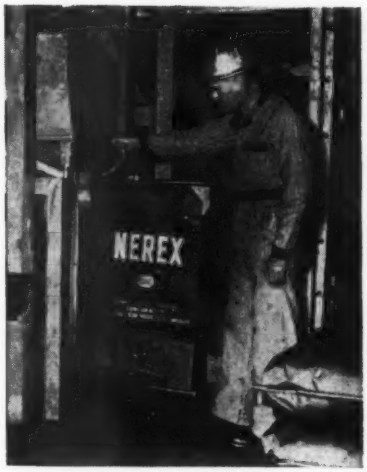
acf MINE CARS *for Constant Haulage*

LOX Blasting Costs Reduced By Shift to New Type Carbon

Faced with an insecure supply of carbon, one of two ingredients in liquid oxygen explosives (LOX), a pioneer user of LOX began searching for a new source. The carbon had to meet specific requirements, including high factors of safety and efficiency and low cost. A new type carbon was developed and field results have been highly encouraging. Two authors collaborate to outline the characteristics of the new carbon, describe blasting practices used by Enos Coal Mining Co., and present blasting costs

A New Liquid Oxygen Explosive



Bagging of Nerex

By D. W. MOGG
Project Supervisor, Great Lakes Carbon Corp.

The writer wishes to express his great appreciation to the management and all personnel of the Enos Coal Mining Co. for their valuable cooperation in the development and testing of the new explosive. Important assistance was also received from the Colorado School of Mines Research Foundation and the L'Air Liquide organization in France. Both of these organizations conducted a number of tests on experimental carbons which were forerunners of the final standard product.

LIQUID oxygen explosives (commonly abbreviated LOX) consist of liquid oxygen plus combustible material, which is usually a finely divided carbon. By themselves, the carbon and oxygen are not explosives, but when the two are combined, a very powerful explosive is formed if the carbon has the proper characteristics. In the usual method of combining the two ingredients, cartridges are made by packing the carbon into cloth bags. The cartridges are then soaked in liquid oxygen in an insulated "soaking box" until the carbon is fully saturated.

Carbon-liquid oxygen explosives have been used in open-pit blasting operations for many years, but their use on a wide scale has been retarded by the shortcomings of the carbons which have been available. Different carbons have had different drawbacks, but in general the most serious have been poor safety characteristics, high cost, poor uniformity and limited supply.

Assuming that the liquid oxygen is of high purity, the differences between various carbon-liquid oxygen explosives are entirely due to differences in the carbons. Liquid oxygen explosives employing different carbons exhibit a wide variation in properties. In safety characteristics the differences can be extremely great, as the test data given in this article will illustrate.

New Carbon Developed, Tested

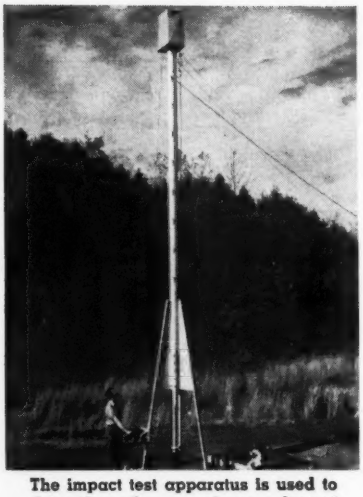
The purpose of this paper is to describe a new LOX carbon and the explosive obtained by combining this carbon with liquid oxygen, and to report the results which have been obtained in blasting overburden with this explosive in the pits of The Enos Coal Mining Co. The new carbon is radically different from any carbon previously available for use in LOX explosives. One of its most important advantages is the fact that it gives a very safe explosive without requiring any flameproofing. It is low in cost, very uniform, gives an explosive which has good brisance, and can be made available in unlimited quantities.

The new carbon was developed at the Morton Grove, Ill., laboratories of Great Lakes Carbon Corp. and is being marketed under the trade mark "Nerex."

The testing of Nerex explosive has been a cooperative project of The Enos Coal Mining Co. and Great Lakes Carbon Corp. and was carried out at the Enos mine. In September 1955 a testing station was set up at the mine with equipment for measuring the more important properties of LOX and other explosives. Since proving the safety of the new explosive it has been used for the blasting of Enos overburden, and careful records have been kept to permit an accurate evaluation of performance and cost.

The work at the testing station included measurements of detonation rate, cartridge life, sensitivity to low velocity impact, sensitivity to rifle fire and burning tests conducted both with and without confinement. No attempt was made to obtain accurate quantitative measurements of the power of Nerex explosive. The ultimate test of the performance of any explosive is its performance under the actual blasting conditions encountered by the user. Therefore, it was left to Enos blasting personnel to determine to their satisfaction the performance of Nerex in their various strip banks.

Nerex carbon is produced from coal by a unique process which converts



The impact test apparatus is used to determine the maximum impact energy to which an explosive can be subjected without getting a detonation of any kind

the coal into a highly porous carbon having a very low volatile matter content. The coals which are used in this process must have certain characteristics but are available in such abundant supply that there is no practical limit to the amount of the carbon which can be produced. Nerex is not a by-product; it is the main product of the manufacturing process.

Properties Described

In all of the LOX tests described here the cartridges were soaked in liquid oxygen until fully saturated. After removing them from the oxygen they were tested promptly so that the oxygen content at the time of the test was very close to the saturation value.

The rate of detonation of Nerex was determined by means of an electronic timer. The cartridges used in these tests consisted of Nerex packed to a density of 16 to 18 lb per cu ft in long two in. diameter bags. The cartridges were not confined. Under these conditions the rate of detonation is 12,000 to 13,000 fps.

How Safe Is New Product?

The explosives which were compared to Nerex in the safety tests are described below:

Flameproofed char: This is the LOX carbon which was used in Enos blasting from 1941 to 1956, with an excellent safety record. It is a char type carbon flameproofed by addition of phosphoric acid and water.

Lampblack No. 1: A lampblack which has been widely used in LOX blasting for a number of years.

Lampblack No. 2: A lampblack which has been used in commercial LOX blasting, but not as extensively as Lampblack No. 1.

Dynamite No. 1: A 40 percent extra gelatin dynamite.

Dynamite No. 2: The most inexpensive dynamite produced by one of the leading manufacturers. This dynamite contains a high percentage of ammonium nitrate but can be detonated without using special primers.

In all of the tests, the Nerex was tested without flameproofing of any kind.

Low Velocity Impact Tests. In this test a 200-kg (441-lb) steel weight is dropped on a 1¼ in. diameter by 1 in. long sample of the explosive. The drop height can be varied from 0 to 21 ft to get different impact energies. The maximum energy obtainable with the apparatus is 9260 ft lb.

The different explosives were compared by determining the maximum impact energy to which each could be subjected without getting a detonation of any kind in 10 consecutive tests. For each explosive, the maximum drop height and impact energy which did not give a detonation is shown below:

Explosive	Height ft	Energy ft lb
Nerex	21.0	9260
Flameproofed char	21.0	9260
Lampblack No. 1	1.50	660
Lampblack No. 2	.25	110
Dynamite No. 1	.167	73
Dynamite No. 2	.50	220

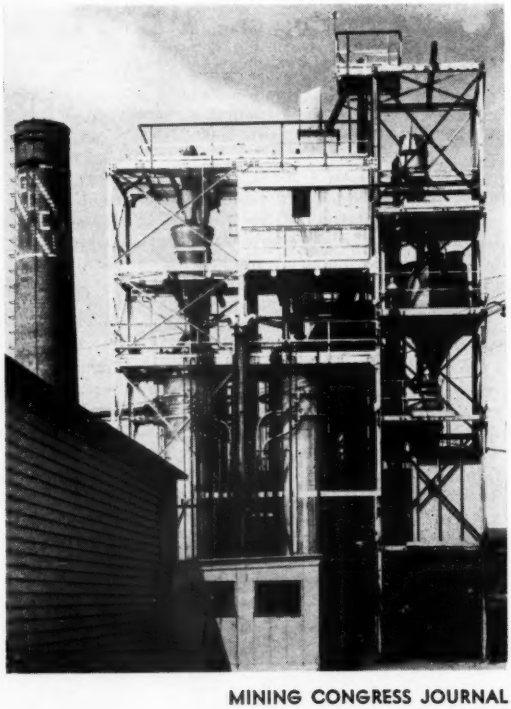
These results show that Nerex explosive has extremely high resistance to initiation by impact. In over 220 tests at the maximum impact energy of the apparatus, using more than 200 samples taken from material produced during a period of 14 months, no detonations or partial detonations were obtained with Nerex. In contrast to this, Dynamite No. 1 and Lampblack No. 2 gave strong detonations at only 1/84 and 1/42 of this energy respectively.

Rifle Fire Tests. These tests provided information on the sensitivity of the explosives with respect to impact of a different type and much higher velocity than that provided by the low velocity impact test. The cartridges used in this test were approximately five in. in diameter. The cartridges were placed against an earth bank and were hit from a distance of 160 ft using a 30-06 Springfield army rifle. Tests were made with both expanding bullets and U. S. Army tracer bullets.

All of the rifle test results are given in Table I. Dynamite No. 1 was not tested because it was not available in large diameter sticks.

There were no detonations of Nerex in any of the rifle tests, and the average amount of burning was slightly less than with the flameproofed char. Dynamite No. 2 and both lampblacks proved to be much more sensitive to rifle fire than did Nerex. In all three of the dynamite tests the first bullet hit gave a strong detonation.

Semi-confined Burning Tests. These tests were intended to simulate the conditions that would exist if a partially confined LOX cartridge, such as a cartridge in a partially loaded drillhole, should catch fire. Cartridges, 1¼ in. diameter by 8 in. long, were ignited inside an iron pipe arrangement which provided a controlled degree of confinement.



Reactors and feed system of Nerex plant. Nerex carbon is produced from coal by a process which converts the coal into a highly porous carbon having a very low volatile matter content

Lampblack No. 2 was not tested because of its poor showing in the impact tests. The other three carbons were all tested under the same conditions. The table following shows the frequency with which detonations were obtained with each carbon.

These results indicate that when ignited under partial confinement both Nerex and the flameproofed char are much safer than Lampblack No. 1. The flameproofed char gave a slightly lower detonation frequency than did Nerex, but the two carbons may be equal within the accuracy of the test method.

Explosive	Frequency of Detonation (%)
Nerex	16
Flameproofed char	11
Lampblack No. 1	50

Testing New Explosive in the Field

By C. C. WOOLSEY

Drilling and Shooting Superintendent,
The Enos Coal Mining Co.

THE Enos Mine, opened in 1919 by George A. Enos, is one of Indiana's largest and most modern open-pit operations. It is located in Pike County near Oakland City, Ind. For the past several years, the annual production of coal has exceeded 1,000,000 tons, and has been as high as 1,500,000 tons.

The mine is a two-pit operation. In recent years two 750-B Bucyrus-Erie stripping shovels have been replaced by two 1050-B Bucyrus-Erie stripping units, originally having a bucket size of 36 cu yd capacity. In 1955 the shovel in the West Pit was equipped with a 45 cu yd bucket of T-1 steel, rounded lip design. This bucket has proved satisfactory and another is being manufactured for the Main Field shovel. The two stripping units, which are operating a good percentage of the time in banks exceeding 60 ft in depth, are each assisted by a 5-W Monighan pull-back machine with six cu yd buckets. The Main Field 5-W Monighan pull-back machine will soon be replaced by a 7400 Marion electric dragline. These 45 cu yd shovels are capable of moving over 1,000,000 cu yd per month under proper stripping conditions in a well shot bank.

The daily mine output ranges between 6000 and 6500 tons. The coal is loaded with three loaders, a 100-B with a 50-B helping in the West Field pit, and a 75-B in the Main Field pit. The coal haul is approximately nine miles per round trip, and is transported with 50-ton Dart trucks, equipped with Cummins Diesel motors.

Liquid Oxygen Plant

We can safely say that The Enos Coal Mining Co. was the pioneer in the use of LOX in blasting overburden for coal stripping. In the year 1926 a liquid oxygen plant was purchased from Air Reduction Co. and moved to the Enos property. This is a French plant, using the Claude process. The capacity of this installation is 160 liters per hour (4.8 tons per 24 hour day), but the innovation of larger stripping units, necessitated by higher and harder overburdens, increased our demand for explosives far beyond the plant capacity.

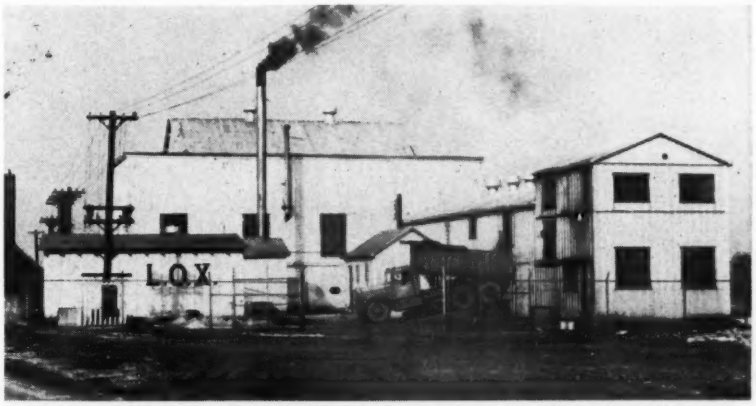
About seven years ago Enos installed a new plant, purchased from L'Air Liquide, Montreal, Canada. This tripled production of liquid oxygen, the plant having a capacity of 300 liters per hour (9.0 tons per 24 hour day). It requires a working force of eight men—four operators, three men making cartridges, and a foreman. This plant operates around the clock seven days per week and has very little down time. It has a four-stage compressor that develops 2200 lb working pressure. The new unit produces liquid oxygen of 99 percent purity, whereas the older units make a purity of 90 to 92 percent.

The liquid oxygen is delivered from the column into two 625 liter storage tanks inside the plant, and is blown through a transfer pipe to a 15,000 liter storage tank located approximately 100 ft away in the pouring house. This cylindrical storage tank is located between two driveways and has two 1½-in. pouring spouts on each side. Soaking boxes lined with stainless steel and insulated with fiberglass or Santocel contain 30 and 35 8½ in. diameter cartridges. Four boxes can be poured and soaked simultaneously, two each on separate trucks. This operation can be done in less than ten minutes. The entire plant includes facilities also for production and soaking of cartridges, as well as manufacture and storage of liquid oxygen.

Cites Manufacturing Costs

During the year 1955 the Enos LOX plant produced 6,120,528 lb of liquid oxygen, at a cost of $0.0149 per lb (mine cost only), as shown below.

Payroll	$33,203.11
Power (@ $0.012 per kwh)	44,254.68
Supplies and Repairs	13,640.46
Total	$91,098.25



The Enos LOX plant includes facilities for production and soaking of cartridges as as well as manufacture and storage of liquid oxygen

The cost of making cartridges for the month of August 1956, which could be taken as a typical month, was as follows:

	Cost Per Cartridge
Liquid Oxygen	$0.8145
Carbon (Nerex)	.7019
LOX fireproofed bag	.2162
Payroll (filling bags)	.1934
Miscellaneous	.0160
SF pads (cartridge insulators)	.0374
Total	$1.9794

Why Change Explosives?

For the past 15 years, Enos has been using the Bugbird carbon furnished by West Virginia Pulp and Paper Co., and manufactured from the residue lignins from a pulp mill. This char since 1941 has been fireproofed by adding phosphoric acid and water in the amounts of approximately 10 percent and 22 percent respectively. (The cartridges dry out somewhat during storage; at the time of use, the moisture content is usually about 18-20 per cent.) This was done as a safety measure for protection against impact and hazards of incendiary origin. Approximately 200,000,000 cu yd have been shot during this period, using over 30,000,000 lb of LOX explosive without an explosive injury to any member of the shooting crew or any damage to equipment.

Why then did Enos change its LOX absorbent and adopt "Nerex"? To begin with, we had no assurance that we could obtain our char indefinitely. Therefore, for the past three years, we had been searching for another absorbent—first, with the safety characteristics of the flameproof char; second, a product equally efficient or better in breaking our overburden; third, if possible, a carbon at a cheaper price; and fourth, a reputable supplier with assurance that our needs would be taken care of in the years to come. Great Lakes Carbon Corp. developed their carbon, Nerex, and fulfilled the above requisites.

Before changing our explosive, the Great Lakes crew (at the experimental station set up on our property) demonstrated the safety characteristics of their product to our entire shooting crew in a satisfactory manner. They were shown comparative impact tests, rifle tests and burning tests, to prove to them that we were in no way sacrificing our previous standards of safety. The men were convinced and willing to carry on their work in the field with the new explosive.

Field Tests Satisfactory

The next step was to test the Nerex absorbent in the field. In March 1956, 20 holes were loaded and shot, using 2000 lb of the carbon. This was done in two ten—hole shots. The results were very satisfactory, and it was then decided by the Enos management to use this new LOX explosive in the Main Field only, which was all vertical drilling for the next several months, in order to evaluate the results from the standpoint of fragmentation and also in dollars and cents.

During the period March 1956 to October 1, 1956, the mine used 221,046 lb of Nerex. This represents 22,438 cartridges, and in broken bank totals approximately 3½ million cu yd. This explosive has been used in various types of materials and in banks ranging from 50 to 89 ft in height, the average height for the above period being 63 ft. The shovel performance showed a gain of five percent in cubic yards per hour. This is not attributed to the use of the different explosive, but is mentioned to show that no sacrifice has been made in bank preparation.

It has recently been decided to discontinue the use of the flameproof char entirely, and when the present supply is exhausted, both pits will be shot with the new absorbent. Our second 50-R drill was installed in the West Field pit in September 1956, and several shots in this field were made with the new explosive in a bank 80 to 89 ft in depth, providing good bank preparation.

Savings Noted

The savings to the company through this new type of absorbent are as follows:

(1) Cost of carbon reduced $0.02 per lb.

(2) Cost of phosphoric acid eliminated—approximately $10,000.00 for the year, 1955.

(3) Cheaper labor cost in manufacturing cartridges. (Time saved by not applying water and acid, and each bag contains 10 lb of absorbent instead of 7.5 lb.)

(4) Saving in explosive bag cost. (More explosive per cartridge.)

(5) Saving in liquid oxygen, because fewer boxes of explosive are required due to increase in explosive per cartridge.

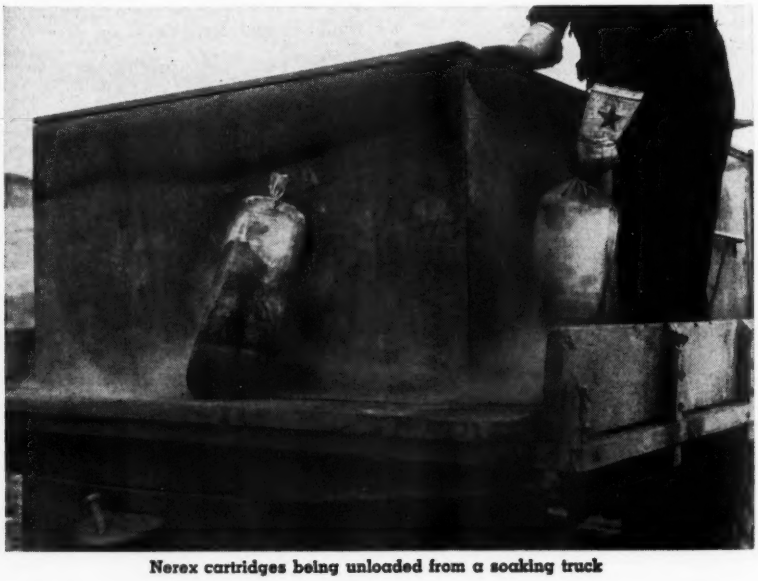
(6) Saving in shooting labor.

The total savings of the above mentioned items we feel will be significant. At this time we cannot arrive at any definite total, due to the fact that we have been using two carbons, as well as two methods of shooting. In the months to come we will settle down to one type of explosive, and also will be standardized on one type of drilling and shooting. Then the savings can be evaluated.

Standardized Method of Drilling and Blasting

The drilling and shooting for both pits will follow the pattern of the last 16 months in the Main Field, at which time we converted from a combination of horizontal and vertical method to all vertical. At this time, we installed our first 50-R Bucyrus-Erie blast hole drill. Our second 50-R, as aforementioned, is now in operation in the West Field pit.

We are drilling a 10⅝ in. diameter hole, spaced on a pattern of 30 by 27 ft, which calculates a yardage of 30 cu yd per ft of hole. The drill holes are staked by the engineering department and located on maps, followed by the drill hole data and also the explosive charge per hole. This provides complete information for daily yardage estimates. The shovel cuts are also plotted on these maps, and the shovel yardage is rechecked and calculated at the end of the month.



Nerex cartridges being unloaded from a soaking truck

The 50-R drill in the Main Field is averaging 750 to 800 ft per day, for 6¾ hour over-all drilling time day. The bit life of the Hughes OSC and W7RJ Aerojets ranges from 12,000 to 20,000 lineal ft, depending upon the character of the rock formation. This pit has different formations in different areas. In our higher banks, we have a formation of lime boulders near the surface, ranging from two to seven ft in thickness. These boulders present problems in stripping, as well as in the drilling and shooting. In the southeast area, we have slate, shale, steel band, limestone two to five ft, then hard sandstone up to forty ft in thickness.

Every Shot Supervised

The holes are laid out in group shots of from 10 to 18 holes, depending upon conditions and depth of overburden. Shots usually contain from 650 to 850 lineal ft of drill hole, which represents approximately 20,000 to 25,000 cu yd per shot. Usually, three shots are made per day with a crew of ten men and one shooting foreman. Our LOX labor cost approximates ½ cent per cu yd. The penalty of this high labor cost is amply compensated for in the inexpensiveness of the explosive. Every shot is supervised. The over-all time required to load, connect up, and fire the shots usually averages 35 to 45 minutes. Good results have been obtained up to one hour. The loading charges are calculated by the foreman on a basis of cubic yards per LOX cartridge. Shots vary from 140 to 180 cu yd per cartridge. The efficiency of the shooting can be easily pinpointed by the location and digging of the shovel, and future shooting can be heavier or lighter, as desired. The holes are fired with Austin detonating fuse and delayed with MS connectors, so that no two holes are fired at the same time. The last two holes adjacent to the next shot are delayed more than the other holes, to protect the first holes in the following shots. Occasionally a hole is damaged. If so, it is loaded with eight-in. diameter Akremite in bag form, or if the hole is too badly damaged, the Akremite is poured into the hole.

The new Nerex liquid oxygen explosive cartridge in a fireproofed cotton bag with corrugated paper insulator liner contains ten lb of dry absorbent. Fully saturated, it weighs about 45 lb. Most loaded holes contain two charges, one in the bottom of the hole, and the top charge approximately two ft above the "rooster" vein of coal. The holes are effectively stemmed with the drill cuttings around the collar of the drill hole.

Following is a resume of vertical drilling and shooting in the Main Field for the month of August 1956:

DRILLING 50R—AUGUST 1956

Holes drilled	456
Ft drilled	28,650
Hours drilled	186.25
Hours worked	261.00
Shifts worked	36
Percent active	71.36
Average depth hole	62.83
Ft hour drilled (actual)	153.83
Ft hour worked	109.77
Ft shift	795.83
Cu yd drilled	859,500

SHOOTING—AUGUST 1956

Stripping units	1050-B—36 cu yd bucket 5-W—Pull-back 6 cu yd
Number of shots	41
Number of holes shot	487
Number of ft shot	29,770
Spacing	30 x 27
Number of cu yd shot	884,030
Cu yd shot per ft of hole	29.7
Number of Nerex cartridges	5,800
Number cu yd broken per cart	152.6
Average height of bank	62.5
Maximum cu yd broken per car for month period (May 1956) 33.61 cu yd per ft of hole	178.1

Conclusion

Tremendous strides have been made in recent years in making LOX safer to handle and use in open-pit blasting. All explosives are potentially hazardous, and every type of explosive, irrespective of its relative safety, should be prepared, handled, stored and used with utmost respect at all times and under all circumstances. Modern explosives can be utilized advantageously in our industrial use with a considerable degree of safety.

It is more difficult to promote detonation of an explosive at low temperature (liquid oxygen, minus 183°C) than at normal temperature (25°C). However, given a sufficiently powerful detonator for its establishment, detonation will proceed through the explosive at its normal rate regardless of temperature. Primacord or Austin detonating fuse is not affected by the low temperature of LOX as used.

Liquid oxygen explosives, being unique in nature, necessitate loading and handling techniques other than standard practices as prescribed for fixed explosives. Use of LOX is dependent upon certain conditions. However, there are numerous open-pit operations that could adopt liquid oxygen explosives First, management must sincerely want it to succeed. It will require more study and planning to blend in the drilling and blasting operations with other departments, namely, loading, hauling and stripping. For these inconveniences, one is amply compensated by savings in explosive costs.

Enos is very proud of the work done by Great Lakes Carbon Corp. It has been a pleasure working with them in the development of this new LOX explosive. We feel that we have the safest and most economical explosive (Nerex and liquid oxygen) in the field today. We do not claim perfection. Improvement might yet be made along the lines of better absorption, retention and brisance, with no sacrifice of safety.

TABLE I. RIFLE TEST RESULTS

Explosive	No. of Tests: Expanding	No. of Tests: Tracer	Total No. of Bullet Hits: Expanding	Total No. of Bullet Hits: Tracer	Results
Nerex	4	9	13	24	There were no detonations of any kind. In one tracer test the entire cartridge burned up. In two other tracer tests there was slight local burning lasting less than 3 seconds. No other burning.
Flameproofed char	2	7	8	20	No detonations. In one expanding bullet test entire cartridge burned up. In one tracer test there was local burning lasting 15 seconds. In two other tracer tests and one expanding bullet test, there was slight local burning lasting less than 3 seconds.
Lampblack No. 1	3	2	8	4	Strong detonation in all expanding bullet tests. In one tracer test entire cartridge burned up.
Lampblack No. 2	3	4	7	9	Strong detonation in all expanding bullet tests. Slight local burning lasting less than 3 seconds occurred twice in one tracer test.
Dynamite No. 2	2	1	2	1	In all tests the first bullet hit gave a strong detonation.

The How and Why of Pressure Leaching and Precipitation Processes

An appraisal of pressure hydrometallurgical processes that examines the principles involved, potential applications, and the feasibility of conducting operations of this type successfully on a practical basis

By FRANK A. FORWARD
Head of the Department of Mining and Metallurgy, University of British Columbia

DURING the past five or six years much has appeared in the technical and patent literature on the use of elevated temperature and pressure in hydrometallurgical processes for treating ores, concentrates, mattes, scrap and other materials to extract nonferrous metals and to separate, and recover these metals from the leach solutions by precipitation with hydrogen, carbon monoxide or other reducing gases. Some of the publications have discussed the theoretical aspects of these processes, others have speculated more or less optimistically on the wide variety of expected applications, while still others have described operating results in pilot plants and successful commercial operations.

In the same period the research and development groups of a number of operating companies and commercial organizations have accumulated a store of experimental and operating data that has not been made public. Many of the aspects of the work in this general field which have been discussed both formally and informally at scientific and technical gatherings are, similarly, as yet unpublished. The true extent of the information available and the views of many who have taken an active interest in it can, therefore, be only surmised.

Aspects of Situation Outlined

Although the pressure leaching and precipitation processes have attracted a certain amount of attention there remains, in the minds of many, a degree of uncertainty concerning the principles involved, the potential applications, and the feasibility of conducting operations of this type successfully on a practical basis. It seems, therefore, not untimely to examine these matters and to attempt to provide an appraisal of the present status of pressure hydrometallurgical processes.

The aspects of the situation which it is proposed to discuss in making such an appraisal may be conveniently outlined as follows:

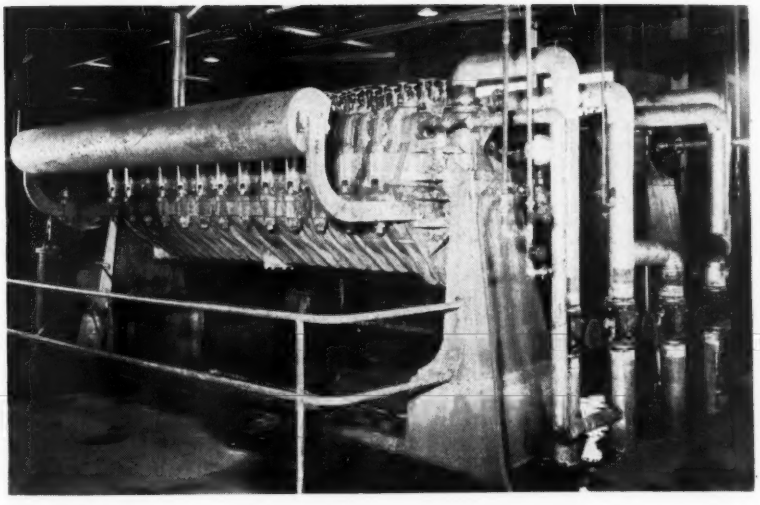
(1) Principles: The successful application of pressure processes in metallurgical operations depends in the first instance on a thorough and sound knowledge of the chemical and physical principles that determine the behaviour of gases, salts, minerals, and other compounds in aqueous solutions at high temperatures. The amount of reliable scientific data in this field is surprisingly (and deplorably) small.

(2) Limitations: Although most chemical reactions proceed more rapidly at higher temperatures, the increased rate is not necessarily a favorable factor as, in some instances a second, unwanted reaction might take place. Occasionally, increased pressure has no effect whatever on reaction rate or the required pressures may be so astronomically high that their use would be impractical. Every ore and every process must be studied individually.

(3) Engineering: Many physical problems are involved in devising practical, low-cost methods of carrying out reactions at the higher pressures and temperatures involved in pressure processes. Many of these problems have already been solved but, as in any developing technology, improvements will be made in the course of time.

Merging of Concepts

There is a popular belief that hydrometallurgy and more particularly the technology of high pressure hydrometallurgical processes, represents a merging of the principles and techniques of chemical engineering and the chemical industry with those of metallurgical engineering and the mineral industry. To a large extent this is true but, because the concepts of the chemical industry differ fundamentally from those of the mineral industry, it is not a simple matter for one steeped in the philosophy, science or practice of either of these groups to change at will to the other and hope to have an adequate understanding of its intricacies. Nor is it possible to



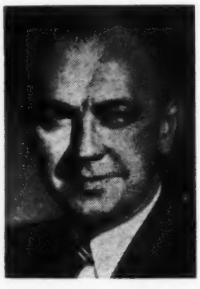
Pressure processes have interesting possibilities but they must be tailored to suit individual requirements and applied where chemical, physical, and cost advantages exist

Hooded disc filters are used in this leach residue washing circuit. Leaching is inherently a process associated with oxidized materials in which the mineral is simply dissolved

The technology of high pressure hydrometallurgical processes represents a merging of the principles and techniques of chemical engineering and the chemical industry with those of metallurgical engineering and the mineral industry

FRANK ARTHUR FORWARD, author or co-author of some 10 or 12 published papers on hydrometallurgy and principal or joint inventor in a number of issued patents, has a broad background of experience that makes him particularly well qualified to discuss the practical aspects of pressure leaching and precipitation processes.

Forward's career dates back to 1923 when he went to work for the British American Nickel Corp., Deschenes, Quebec.



In 1924 he transferred to the Consolidated Mining and Smelting Company of Canada, Trail, B. C., and became successively assayer, shift engineer-lead smelter, and research engineer. From 1929 to 1934 he was assistant smelter superintendent of Mt. Isa Mines, Ltd., Mt. Isa, Queensland, and from 1934 to 1935 assayer and metallurgist for the B. C. Nickel Mines, Choate, B. C. Since 1935 he has been associated with the University of British Columbia where he is now head of the Department of Mining and Metallurgy.

In addition, Forward has undertaken numerous consulting assignments and was technical director (1941-45) of the British Columbia War Metals Research Board.

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transfer the thinking or technology from one group to the other, or to superimpose them upon, or combine them with, one another by brute force simply because it seems useful to do so. It takes time to develop an understanding of mutual interests, methods and limitations that will in the long run react to the benefit of both.

Outlook—Synthetic Vs. Analytic

One of the basic differences between the two industries is that the outlook of the chemical industry is largely synthetic, while that of the mineral industry is analytic. The chemical industry uses as starting materials a few simple substances, usually available in large quantities at many locations throughout the world and usually of nearly constant composition, such, for example, as air, limestone, coal, coke, salt, sulphur, natural gas, oil, and cellulose. From these, by the application of energy and the use of a wide variety of techniques, are produced the multitude of chemical products—petrochemicals, plastics, paints, explosives, acids and others—that are in such common use. The primary metallurgical industry, on the other hand, produces a relatively small number of end-products—refined metals, steel ingots, ferro-alloys—but uses as starting materials the metallic minerals that occur in various concentrations at diverse locations with compositions, physical form, and associations that are unique for each occurrence, often differing widely within the confines of a single deposit.

Associated with this difference is the fact that, by and large, the chemical industry is not too seriously concerned with the availability of raw materials or the depletion of resources but must depend very much upon the ingenuity of the operating groups and their ability to carry out at the lowest possible cost the intricate and complex operations required to produce a variety of end-products. The primary metallurgical industry, however, is very much concerned with the availability of raw materials and their inevitable depletion. Here the operator's objective is to carry out at minimum cost, and often enough in a limited period of time, the smallest number of operations that will produce one, two, or three marketable end-products from a single deposit or group of deposits which require a custom-tailored process. It is not difficult to understand why chemical companies place so much stock in patents while metallurgical companies depend for their income upon the efficient exploitation of the expendable resources of a mine. Perhaps this explains also why the chemical industry spends on research proportionately about ten times as much as the metallurgical industry.

Technological Differences

Technologically the differences are almost as great. In the chemical industry the engineers and technologists by and large have little to do with solids. Their activities are related principally to physical processes associated with gases and liquids—the addition or removal of heat, evaporation, condensation, effects of pressure, concentration, viscosity and diffusion, phase boundary effects, and other similar agencies in liquid and gas phases. They are interested too in the movement of fluids in pipelines and reactions and the mechanical devices required to carry out these operations. To the chemical engineer the chemical reaction is often enough incidental—his objective is usually to provide the physical and mechanical means to carry out a specific reaction in a practical and economic manner.

The engineers and technologists in the mineral industry are confronted by a somewhat different situation. In the first place all metallic minerals are solids and every metallurgical engineer is concerned in some way with the behavior (and idiosyncrasies) of solid materials. He must think in terms of crystal forms, of diffusion in solids, of the reactions at solid-liquid and solid-gas interface, and of the peculiarities of mineral particles and metallic surfaces. He must deal with solid particles suspended in liquids or gases, with dust recovery, with the segregation of coarse and fine particles, the comminution and separation of solids, and with many other similar problems, and must be familiar with the techniques associated with high temperatures, including handling and treating molten materials and hot gases.

Also, the production of pure metals, ferro-alloys or steel is a complicated chemical process. The metallurgical engineer working in this field is interested not only in the physical characteristics and procedures above mentioned, but he is seriously concerned with the chemical reactions involved. The treatment of each new ore presents a new chemical problem—the relative amounts of impurities present and the difficulty of removing them differ greatly as do the treatment methods necessary to take care of them. To the metallurgist therefore the chemistry of the process is of prime importance.

Must Work Together

What, one may ask, has this to do with hydrometallurgy? The answer is simply that in this field and particularly when high pressures are involved there is a merging of the conceptions of the two groups in an area where each has much to learn from the other.

The problems in this field must be approached with an open mind and with a full realization of the chemical and physical factors involved, an appreciation of the character of minerals and metals, and recognition of the fact that high pressure hydrometallurgical operations will be concerned with solids as well as liquids and gases. Once these conceptions are accepted, and they are given time to mature, the problems of efficient plant design become almost entirely those of selection of chemical process and devising efficient materials, handling and control techniques, many of which are well known in one field or the other but can best be adapted by collaboration between open-minded competent people from both fields working together.

Bearing in mind these characteristics one might well ask: Where do we stand today? What are the prospects of broader application of high pressure techniques in the mineral industry? Are the operations at elevated temperatures and pressures technically and economically feasible?

Some of the factors that have a bearing on the answers to these questions are outlined under the headings mentioned earlier—principles, limitations and engineering.

Principles

In hydrometallurgical processes of all kinds, whether at atmospheric pressure and ambient temperature or at elevated pressure and temperatures, there are two essential steps—leaching and precipitation. (To these may be added the various physical or chemical techniques involved in seperating and purifying the solutions or products.)

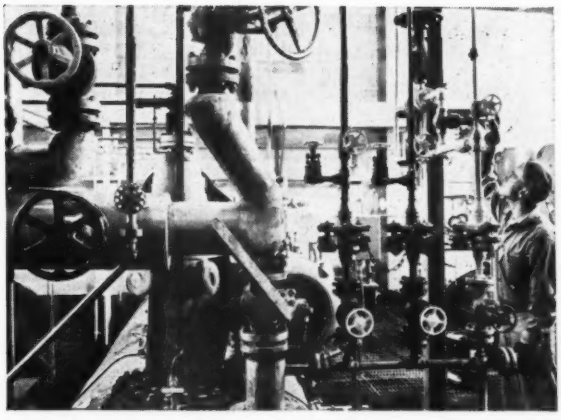
Leaching is inherently a process associated with oxidized materials in which a mineral that is already oxidized is simply dissolved, or if it is an incompletely oxidized mineral such as pitchblend, a sulphide, or a metal, native copper for example, it is oxidized either before or during leaching. Fundamentally oxidation is a loss of electrons and oxidizing agents such as chlorine, oxygen, nitric oxide, sodium chlorate or permanganate are substances that, to achieve their most stable state, require electrons and which actively remove electrons from metals or minerals, forming charged metal ions in solution.

Conversely precipitation of metals from solution is inherently a process associated with reduction, or gain of electrons: to precipitate a metal from solution it is simply necessary to add electrons. This can be achieved by passing direct current through the solution, by adding hydrogen, carbon monoxide or other reducing gas, or by adding a more reactive metal which gives up its electrons to the less active metal ions present, itself becoming ionized and dissolving while the less active metal is precipitated.

Because these reactions take place in aqueous solutions, water is always present and there is thus the possibility that either the H^+ or, more likely, the OH^- component of H_2O will react with the metal ions as fast as they are reduced to metal to produce, not metal, but a metal oxide or hydroxoide. Reactive metals like sodium or aluminum for example, if reduced by electrical or chemical means in an aqueous solution, react immediately with the water to produce hydroxide. In fact only a relatively small number of metals can be produced by reduction in an aqueous solution.

Over many generations, and especially in the last 50 years, chemists and physicists have accumulated a vast store of information on the properties and behavior of metal salts in aqueous solutions. Facts relating to concentration, solubilities, boiling points and freezing points, conductivities, vapor pressure and many other properties are well known and definitely established. The behavior of electrolytes, the effect of oxidizing and reducing gases and salts and the phenomena of electrolytic activity are equally well known.

The one aspect of all these studies that has been largely overlooked or possibly side-stepped due to lack of interest or non-availability of simple experimental techniques is the behavior of metal salt solutions at temperatures above the boiling point or at elevated pressures. A search of the scientific literature provides, by comparison, a pitifully small amount of data on any of the reactions of interest in this field. Not until information of this kind becomes available, probably by a process of slow growth, will it be possible to predict the feasible and potentially useful areas of application.



To the metallurgist, the chemistry of the process is of prime importance

Another important subject about which very little is known is the behavior of solids, minerals and metals in particular, in contact with aqueous solutions. The study of reactions at the solid-liquid interface presents many difficulties, matched only by those encountered in trying to interpret the data relating to diffusion within the solid itself or, perhaps, the mechanism of catalysis, so important in metal precipitation. During the past four or five years, a number of papers have been published that throw some light on these matters or they are related to a few specific reactions, but there is still much to be learned about them.

Limitations

From what is known of the fundamental properties of solutions at room temperature and higher temperature, it is possible to predict that certain reactions have little chance of proceeding at any reasonable temperature or pressure, and that others will give unfavorable results.

In leaching uranium minerals in sodium carbonate solution for example, it has been found that if the operating temperature is raised to about 100°-120°C the reaction rate increases rapidly with temperature. If, however, the temperature is raised to 200°C in an attempt to accelerate the reaction still further, the sodium carbonate reacts with uranium ions to form insoluble sodium diuranate which puts an end to leaching. In much the same way in leaching nickel-cobalt-iron sulphide minerals, if the temperature is raised to 90°C or higher, not only do different (insoluble) cobalt compounds tend to form but the residual iron hydroxide absorbs a higher percentage of both nickel and cobalt, rendering the leaching operation inefficient and even uneconomic.

Known thermodynamic data show that it would be impossible to precipitate zinc, for instance, from an aqueous solution with hydrogen at pressures less than about 100,000 psi! That does not mean, however, that, given the right conditions in a non-aqueous organic solution, zinc might not be quite easily precipitated at 300-400 psi. Uranium can not be precipitated as metal from carbonate solutions, but, using a nickel catalyst and hydrogen, can be very easily precipitated as pure UO_2. Lead, because it poisons a catalyst and thus impedes dissociation of hydrogen, is difficult to precipitate from aqueous solutions. These and many other examples that could be cited give some indication of the limitations of pressure processes.

The fact remains, however, that the oxygen in the air is by far the most abundant and cheapest oxidizing agent. If the temperature (and corresponding pressure) of an aqueous solution can be raised to the point where the oxygen will react rapidly enough with a mineral or metal, with or without the aid of an oxygen catalyst, these materials can be fully oxidized and, depending on the properties of the resulting hydroxides, either converted to an insoluble residue or dissolved in the leach solution. The opportunities thus presented for selective oxidation in either acid or basic solution are remarkably numerous and are as yet comparatively little known. One useful example is the oxidation of refractory gold ores whereby the arsenic, iron, antimony, lead and other components are converted to inert oxides while the gold is released and is fully soluble in cyanide solution.

By the same token hydrogen is a readily available (from natural gas or propane) and, reasonably low cost

precipitant. For metals such as copper, cobalt, nickel, precious metals, and for uranium and vanadium oxides and the oxides of certain transition metals with suitable valence characteristics, hydrogen can be considered a useful economic precipitant. Replacing as it does electro winning methods where the energy consumption is high and because the hydrogen can be used at nearly 100 percent efficiency, the precipitation cost will usually be less than for electrolysis. Hydrogen has the advantage that it will precipitate metals from solution in a minute fraction of the time required for electrolysis.

The evidence adduced is sufficient to point up two facts:

First, the utilization of reactions that take place only beyond the boundaries of atmospheric temperature and pressure offers attractive opportunities for extracting and recovering metals by hydrometallurgical processes that would not otherwise be available, but there are thermodynamic and practical considerations of many kinds that restrict their commercial application.

Second, as every ore has its own unique characteristics so must the process to be used be studied and designed to suit each individual need. There is no such thing as a "universal" process either in high pressure hydrometallurgy or, for that matter, in any other primary metallurgical operation.

Engineering

The first and very logical reaction of most metallurgical engineers to the use of high pressures and temperatures in metal winning processes is that the high pressures involved will create serious mechanical and structural problems and that the high temperatures will cause excessive corrosion. While this fear may have some foundation in fact, it is equally true that, in the chemical industry, operations at very high pressures and temperatures and in corrosive media have been carried out successfully for a generation or two. Here then lies the opportunity for an advantageous closer association of the two technologies.

In the plants that have already been built and that are operating successfully as well as in extensive pilot plant operations of proven efficiency, this merging of ideas and techniques has already taken place. Slowly at first, but with increasing speed, difficulties have been overcome and a body of operating experience built up that is little short of surprising. An encouraging feature is that the experience gained is cumulative.

As an example of the present state of development, it might be mentioned that pressure vessels the size of a freight-car (11 by 44 ft) are operating continuously with automatic controls, requiring a minimum of attention, and giving every prospect of operating for many years with no more than routine repairs. In one plant a series of reactions is carried out continuously in several vessels at 500-700 psi without intermediate depressurizing and with all stages fully automatic. Mechanical agitators are being operated through glands which retain in the vessels a pressure of 500 psi of hydrogen without any hydrogen leakage. In another plant a pressure vessel has operated for many months using as a leaching agent strong nitric acid at over 250° F and over 200 psi. In yet another, leaching operations have been satisfactorily carried out in strong acid solutions at pressures of over 500 psi and temperatures above 450° F.

The use of stainless steel, or of brick lining in some cases, or titanium pipes and valves for particularly difficult conditions has solved many of the problems of corrosion. Continuous feeding and discharging with suitably designed feed pumps, heat exchangers and discharge valves have proven to be eminently practical. Competent technical staffs, with open minds, and capable of thinking imaginatively and giving careful attention to detail have already solved a great many of the once-feared problems.

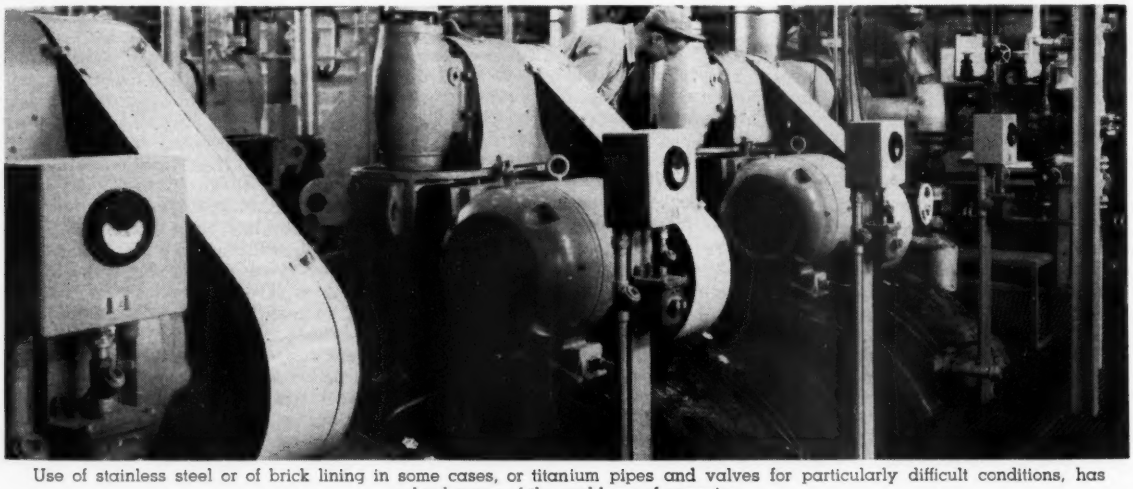
That some remain is, of course, inevitable but it is not being too optimistic to predict that their ultimate solution is equally certain. Because, in this field, it has been necessary to merge two philosophies, progress is not as rapid as many people would like, but it is nevertheless a fact that a sound engineering basis has been established and that the most likely course of progress will be in simplification of equipment, reduction in capital cost of plant and, probably, further automation.

Still Much to Be Learned

In summary it may be stated that, while much has been learned about the chemistry of pressure hydrometallurgical processes during the past few years, there is still much to be found out. The study of basic principles offers an attractive field of scientific research that could well be examined in both detailed and broad aspects.

Pressure processes have interesting possibilities but they must be tailored to suit individual requirements and applied where chemical, physical, and cost advantages exist. They provide no panacea but they can open up new approaches to metal recovery.

A substantial body of engineering information has been built up in the past three or four years; seemingly difficult technologic problems have been solved most satisfactorily and it can be proposed with reasonable confidence that if a process is chemically sound a plant can be built to carry it out at pressures up to 700 psi and temperatures as high as 500°F. The operating costs of some plants are already low but engineering developments will tend to reduce them still further in the course of time.



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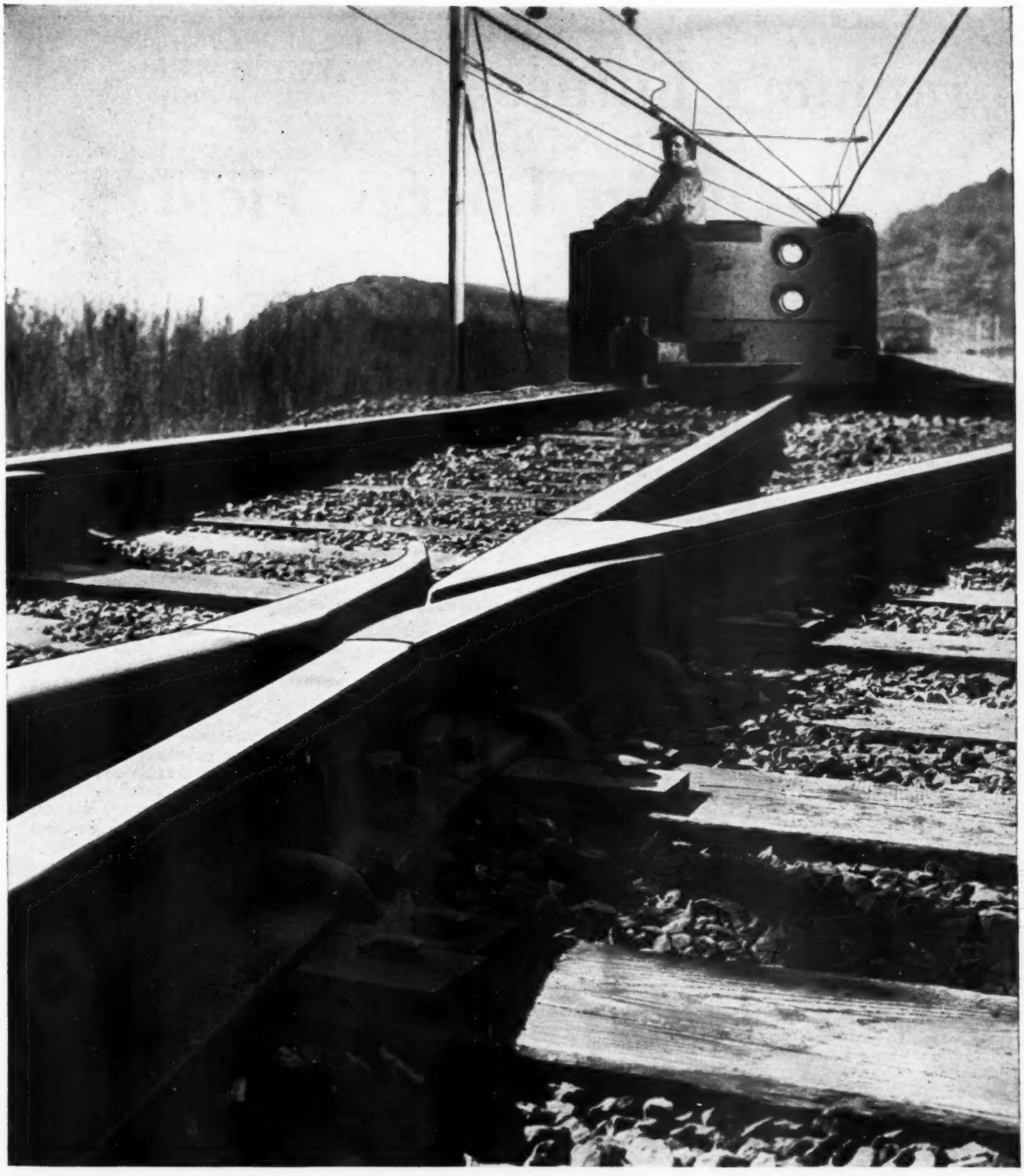

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Uranium's Future in the Energy Field

Beginning in 1965, annual nuclear fuel requirements promise to rise abruptly, according to the author, reaching a potential demand of 7000 tons of uranium metal in 1970 and nearly 16,000 tons in 1975. Dr. Starr describes the physical process of atomic power generation, the "workings" of different types of reactors, and focuses attention on developments that will lead to the rapid growth in uranium requirements

By CHAUNCEY STARR, Ph.D.
Vice-President, North American Aviation, Inc., and General Manager, Atomics International Division

THE development of nuclear energy as a natural resource is stimulated by the fact that the availability of fossil fuels, coal, oil and gas, and of hydroelectricity appears to be sufficiently limited that within the next 100 years a serious shortage of energy from these sources will appear. Prediction of the world requirements for energy depends directly upon world economic development, which in turn depends upon such factors as the availability of energy resources, their efficiency of utilization, the technological development of the more backward areas, and so many other interrelated factors that accurate analysis is literally impossible. It is possible, however, to project the trends which have been established for some time and to estimate from these the probable magnitude of the future energy requirements. These requirements, of course, need to be compared with the available world resources and these in turn are difficult to estimate accurately. In addition to the unknowns associated with the exploration and discovery of new fossil fuel resources, it is also true that availability of such fuels is associated with their market price. Resources presently considered marginal for economic reasons will be utilized if the market price justified their exploitation and such marginal reservoirs of energy are large in extent. In spite of the qualitative nature of such an analysis, however, it is possible to extrapolate the present rate of discovery of new resources and to determine the probable order of magnitude of the total available resources of these conventional fuels. When such estimates are compared with the estimates for world requirements, the serious nature of our energy resource problem becomes evident.

For roughly the past 100 years the use of primary fuel in the world has grown at a rate of about two percent per year. It is most likely that this usage rate will increase faster than in the past since it appears that the industrialization of any part of the world results in a rapid increase in the per capita utilization of energy. If the world rate of energy consumption increases at three percent per year, the estimated resources of conventional fuels will be close to exhaustion within 100 years. Additionally, there are other factors which tend to intensify this situation; for example, the world output of coal has been increasing at a rate of only ½ percent per year, which is clearly insufficient to maintain the pace set by the world's needs. Undoubtedly, a continuous increase in the market price of coal would stimulate the mining of this resource, and such a price increase would undoubtedly occur if no other energy source would become available.

Need for Early Initiation Of Nuclear Power

With this background picture of the future energy requirements, the potential attractiveness of nuclear energy is evident. If available in sufficient quantities, it must become an essential supplement to hydropower and fossil fuels. However, in view of the many decades which must transpire before this problem becomes pressing, one might well inquire as to the necessity for consideration now of nuclear power development. The answer is associated with the useful lifetime of power generation equipment—what the scientist might call the "time constant" of the problem.

FIGURE 1. COMPARISON OF ENERGY PRODUCED IN VARIOUS FORMS

10,000,000 cu ft of gas
8,000 cu ft of coal
4,700 cu ft of oil
¼ cu in. U-235

All produce an equal amount of energy.

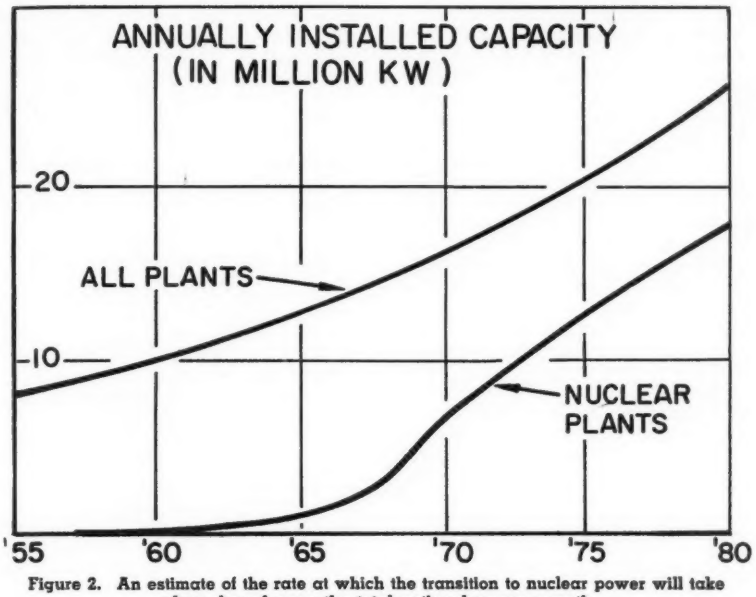


Figure 2. An estimate of the rate at which the transition to nuclear power will take place, based upon the total national power growth

At present, central station power equipment is expected to serve usefully for at least 30 years. In view of the rapid rate at which power generation capacity is being added—in the United States capacity doubles every ten years—nuclear power stations must be placed in use soon, in order for nuclear fuels to be a significant contributor to power generation decades hence. Although development in the nuclear power field is presently under way, it will be ten years before reliable and desirable nuclear plants are demonstrated. If, at that time, nuclear plants represent an increasing percentage of all new capacity added, it will take another 30 to 50 years before they play a dominating role in power generation. For this reason, it is not too early now for the initiation of nuclear power.

Splitting the Atom

The availability of nuclear fuels is clearly a key consideration. In order to understand the factors involved, it is desirable to consider the physical process of atomic power generation.

Atomic energy arises from the splitting or "fission" of certain heavy atoms, such as U^{235}, by neutrons. In the process of such splitting, a considerable amount of energy is released, which can be converted into heat for either explosive or power purposes. The naturally occurring element uranium contains the isotopes U^{235} and U^{238} in the proportion of 1 to 140. The U^{238}, which makes up the bulk of the natural elements, does not have the characteristic of being easily fissionable, as does U^{235}. However, in a nuclear reactor the neutrons resulting from the fission of the fuel (U^{235}) can convert the U^{238} into the artificial element Pu^{239}, which is easily fissionable. In addition, the element Th^{232} may similarly be converted in a nuclear reactor to U^{233}, which is also easily fissionable.

There exist then three useful fissionable materials—U^{235}, derived from natural uranium, and the two manufactured elements, Pu^{239} and U^{233}.

The complete fissioning of one kg (2.2 lb) of uranium will produce energy equivalent to that produced by 20,000 tons of TNT, or 3300 tons of coal, or 7.8×10^{10} Btu, or 2.3×10^{7} kwh. The startling compactness of nuclear fuels is best illustrated in Figure 1, which gives the volumes of varying fuels for equivalent energy production. The small volume of nuclear fuels is dramatic, but unfortunately hard to benefit from in practice. The surface area and volume required for heat removal is so large that this engineering factor determines the size of most reactors. Further, the heavy shielding required to protect personnel from the radiation produced further increases the bulk of material associated with the reactor. Nevertheless, the compactness of the fuel can best be illusrated by the fact that an electrical power plant to duplicate the output of Hoover Dam would only fission (or use up) ten lb per day of uranium.

As a practical matter, it should be emphasized that, due to the existence of so-called "side" reactions (nonuseful absorption of neutrons by uranium), only about 85 percent of the U^{235} atoms exposed to neutrons will fission. The remainder become nonuseful isotopes.

Two Types of Reactors

Practical conversion ratios (atoms formed/atoms destroyed) for mixtures of U^{235} and U^{238} or thorium may range from 0.7 to somewhat more than 1. Plutonium as a fuel can permit somewhat greater conversion since it produces more neutrons per fission (3) than U^{235} (2.5). Obviously, if the conversion ratio is one or greater, the system is self-sustaining and power can be produced indefinitely as long as fertile material (U^{238} or thorium) is supplied. Under such circumstances the initial loading of U^{235} eventually

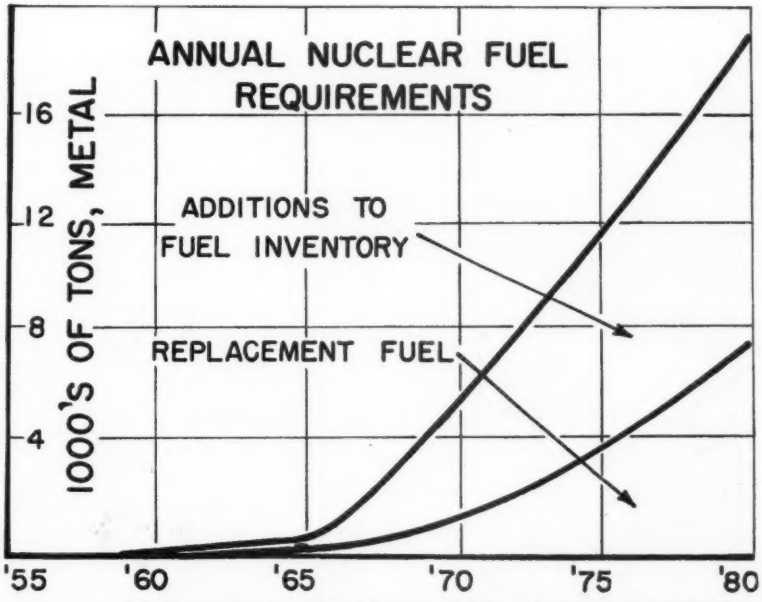


Figure 3. This chart is based on Figure 3 and provides an estimate of the potential uranium requirements for nuclear plants

disappears and the sustaining fuel is the artificial element (plutonium or U^{233}) manufactured in the reactor. Such self-sustaining systems are called "breeders." If the conversion ratio is greater than unity, an excess of fissionable material is produced and can be utilized in other reactors, or stored.

The essential aspect of this short review that is of interest in this discussion is that the "converter" type of reactor utilizes not only the original fuel supplied, but also greatly multiplies the energy available by utilization of the fertile material present. The "converter" requires a source of fuel, however (either isotope separation plants or other reactors), to keep it going. As the conversion ratio increases, the self-sustaining "breeder" is reached, and if the conversion ratio is greater than unity, a surplus of fuel is produced.

The natural uranium supply can be fed into either an isotope separation plant to produce various enrichments of U^{235}, or can be fed directly into nuclear reactors for the production of plutonium. Nuclear reactors can be designed to operate on uranium of various enrichments, from natural uranium up to highly purified U^{235}.

The low enrichment uranium reactors depend upon the existence of isotope separation plants for a reasonable utilization of the U^{235} in our natural resources. For various technical reasons, the conversion ratio for the manufacture of plutonium in such reactors is not sufficiently great to permit a self-sustaining system. In comparison, the high enrichment "breeder" reactors require the isotope separation plants only for their initial charge of fuel. Once started, they supply their own fuel for continued operation and no longer depend on the isotope separation plants.

Breeder Plant Desirable

For maximum utilization of our resources, the very long-term energy requirements would make it desirable to operate the breeder-type of plant. In fact, the existence of atomic power breeders with a breeding ratio of unity (just self-sustaining) would be sufficient to greatly increase the uranium resources available by raising the permissible price for natural uranium. Let us look at the price the breeder plant would be willing to pay the miner for expanded ore supplies. Assume, for example, that a cost of 0.3 mill per kwh was permissible for the feed material to a breeder plant. One gram of completely utilized fissionable fuel produces 23,000 kwh of heat, or roughly 7000 kwh of electricity. Assuming that a practical utilization efficiency might be 50 percent in a "breeder," it would be permissible to pay $1.05 per gram. This is $476 per lb. A similar case would undoubtedly exist for the thorium reserve.

The situation of the "converter" in the power economy is not unlike that of the self-sustaining "breeder," although it is not quite as desirable. One can assume, for example, that a multiplication of the initial fuel by a factor of five is presently reasonable. Then the permissible cost per kilowatt-hour of the fuel fed to the converter plant would be $\frac{1}{28}$ of that in the "breeder," as only $\frac{1}{28}$ of the total supply is utilized. But if the price of natural uranium is less than $17 per lb, the contribution to the cost of power still does not exceed the 0.3 mill per kwh used in the "breeder" example. Therefore, when the cost of natural uranium is low, the converter can produce power at costs that may be quite competitive with that from the self-sustaining breeder.

The economically available uranium resources are therefore expandable by large factors as an approach is made to good neutron economy in converters or breeders. This dynamic relationship between our fissionable material resources and the nuclear performance of power reactors is similar to the existent relationship between the availability of hydrocarbon fuels and the thermal efficiency of conventional plants.

Future Uranium Requirements Estimated

Of obvious interest to the uranium mining industry is some projection of the probable needs in the United States for uranium to supply future nuclear power plants. The growth of the electrical power industry of the United States indicates roughly a doubling of the power capacity of the country every ten years. Based upon the total national power growth, many estimates have been made concerning the rate at which the transition to nuclear power will take place. All such estimates must necessarily be tentative, since such a transition depends on unique development factors and cost improvements in nuclear power which can only be guessed at. Such a guess is shown in Figure 2. It is clear that this projection is based upon the hope that within the next ten years economically competitive nuclear power plants will become available.

An estimate of the potential uranium requirements for nuclear plants, based upon the above "guess," is shown in Figure 3. These fuel requirements are based upon the assumption that roughly 600 tons of natural uranium metal are required to establish the fuel inventory for new plants, for each 1,000,000 kw of capacity. In operating plants, the fuel "burned up" has been assumed to require 50 tons

Figure 4. Soon to be in operation is the Sodium Reactor Experiment, a nuclear power plant being built by Atomics International, a division of North American Aviation, Inc. It is part of the Atomic Energy Commission's program to develop practical and economical power for atomic energy. Heat from the reactor will be converted to electricity in this experimental program

DR. CHAUNCEY STARR obtained both an electrical engineering degree and a Ph.D. in physics from Rensselaer Polytechnic Institute. Following this he became a research fellow in physics at Harvard University. From 1938 to 1941 he was a research associate at Massachusetts Institute of Technology.

At the beginning of World War II, Dr. Starr conducted research work for the Navy Department's Bureau of Ships. In 1942 he

became associated with the Manhattan District, working with the Radiation Laboratory of the University of California at Berkeley, The Tennessee Eastman Corp., Oak Ridge, and the Clinton Laboratories, Oak Ridge. In 1945 he was appointed to the Manhattan District Technical Committee on Inspection and Control of Atomic Energy. He came to North American when the company began work in atomic energy research shortly after the end of the war.

of natural uranium metal per year for each 1,000,000 kw of capacity. These assumptions must be considered only as "rule-of-thumb" measures, since actual requirements will depend on the type of nuclear plant, its nuclear and thermal efficiencies, the fuel cycle, amount of inventory in chemical and fabrication plants, and other factors.

It is evident from the projection in Figure 3 that the requirements for inventory may be about twice that for fuel consumed. This is significant as regards the possible impact of thorium cycles in nuclear plants.

With either the thorium system or the uranium system, the initial start-up of the plant uses U^{235} as the original fissionable material and both systems require about the same amount initially. For this reason, as long as the rate of start-up of new nuclear power plants is large compared to the number which have established steady operation, the demands for natural uranium as a feed for the isotope enrichment process will continue.

Any future projections such as these must be considered as highly speculative. In addition to the uncertainties already mentioned, there are many forces at work which may make atomic power more urgent and make it economically desirable sooner. An interesting study of the energy future of the United States was made by the President's Material Policy Commission in 1952. Its study assumed three percent per year increase in total energy consumption. Electrical power is only a small part of the projected energy demand.

Would Conserve Fossil Fuels

A significant feature of this study is that the basic needs for hydrocarbons which could not be eliminated by nuclear power are likely to be about a third of the total energy requirement. If any consideration is given to conserving our fossil fuels for future generations, the need for initiating the extensive use of nuclear power becomes more pressing. In about 50 years it might conceivably be most desirable if the major portion of our electricity and heat for cities was supplied by central station nuclear power plants. This would preserve our fossil fuel resources for mobile power (automobiles, trains, small ships, and airplanes) and raw material for the chemical industry.

It is possible, of course, that, in addition to the renewable hydrocarbon resources represented by our forests, the synthetic manufacture of hydrocarbons will have been developed. Conversions of this type would inevitably create a new energy demand, but might be necessary to produce the raw materials for our chemical industry. One can only speculate on the nature of a society without fossil fuels available at reasonable cost.

Personnel Evaluation And Training

(Continued from page 73)

For comparison, the following write-up is an example of what was considered a bottom foreman:

"A little suspicious and sensitive. Slightly lacking in self-confidence and leans mildly toward introversion. Shows slight inability to profit from experience. I.Q. Percentile Rank, Based on Norms for Normal Population, is 20. Foreman's Scale Score is 15."

Testing Program Requires Constant Checking

We have had many problems to solve with the installation of the testing program, since, to our knowledge, this had never before been tried to such an extent in the coal mining industry. Other industries, both large and small, have been using similar programs for a number of years, with apparent success. One thing to remember is that a testing program is not just installed and then allowed to drift aimlessly, but, rather, requires constant checking by continual research and periodic evaluation of personnel. Also, it is necessary to have someone on the staff with the technical training to administer a program such as has been outlined.

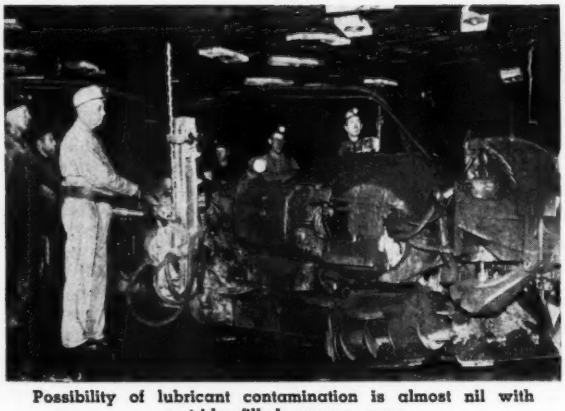
Company Is No Better Than the People It Employs

Personnel testing and meticulous pre-employment screening has given a tremendous boost to our "batting average" in predicting success on the job. Furthermore, a new supervisor, who has been selected by this program, has the fact explained to him that because of the tests we know he can do a good job, and his success should only be dependent upon whether he is willing to make the effort or not, which, in turn, gives the man a good deal of self-confidence. Also, the supervisors who are in our organization know the new supervisors should be as competent as themselves, and that these new people, with the proper training, will be able to hold up their own end of the work.

In the case of the United Mine Worker employes, we are able to evaluate them pretty accurately as to their basic intelligence, even in those cases where individuals are handicapped by a lack of formal education. A good example of this is the Mechanical Comprehension Test, which requires little reading ability, yet does a good job of selecting miners who are both intelligent and mechanically inclined. Therefore, we know there are men in our employ who are trainable to meet the rapid changes which are occurring in coal mine mechanization of today, and the even more rapid changes which may occur in the future.

Of course, on the other side of the ledger, psychological testing programs for selection of employes seem to have a way of propogating a kind of unthinking reliance on their output. We can fool ourselves by accepting too readily their scientific numerical answer as a substitute for human decisions about people. Even if tests can perform an effective job of selecting men with the right talents for a given position, there is such a thing as putting too much reliance upon them. At all times practical values of what the particular job requires are of utmost importance and must not be lost sight of. This paper has made no attempt to properly evaluate that very important phase of selection of people for a specific job.

At the present time, the future of coal mining looks bright. It would seem that one sure way to keep it this way is to increase efficiency not only in better machines, but also in using better men to operate them. We feel that careful selection of personnel should help to achieve that goal. After all, a company is no better than the people it employs.



Possibility of lubricant contamination is almost nil with cartridge-filled grease guns

Most mining operations subject lubricants to severe contamination from dust, dirt and water

Mine Lubricants Handling

By R. B. WHITE
Standard Oil Co. (Indiana)

LUBRICATION is one of the most important aspects of maintenance—one of the easiest to keep running smoothly (and one of the quickest to get you in trouble if you don't follow the rules). The basic ideas behind proper lubrication practices are easy to understand. First furnish the best lubricants available in the types and grades recommended. (A few pennies saved here will never make up for possible increased maintenance due to inferior lubricants.) Second observe recommended practices for storing, handling, transferring and applying lubricants. These practices are the net result of observations of lubrication engineers dealing with all sorts of mining operations over a long period of time.

"Keep It Clean" is your motto for handling petroleum fuels and lubricants. The finest oils and greases made can give quick trouble where careless handling permits introduction of harmful contamination. Mining is a dirty operation at best. Water, dirt, dust, grit are all present in abundance. All are enemies of good lubrication.

Recommended Practices For Receiving, Storing

Good lubricant handling practices start with the delivery of oils and greases to the mine. Petroleum refiners go to great lengths to insure your receiving fuels and lubricants in a clean condition. Package deliveries (drums and smaller packages) require careful handling. Drums should not be dropped off trucks. They should be rolled onto truck-level docks or handled with lift trucks, cranes or hoists. While drums can be rolled by hand short distances to storage areas, lift trucks with special drum handling equipment do a better job for longer hauls.

Sometimes oil is received in drums and transferred to tanks for storage. This is often done by elevating drums above the tank by means of a hoist or rack and draining the oil into the tank. There are also hand or motor-driven transfer pumps which will pump the oil into the tank through a hose.

In all transfer operations, keep scrupulously clean the tops of barrels, funnels, transfer pumps and lines. Protect openings against flying dust or dirt while filling. Be careful not to fill the wrong tank. Accidental mixing of two petroleum products may adversely affect at least one, if not both products.

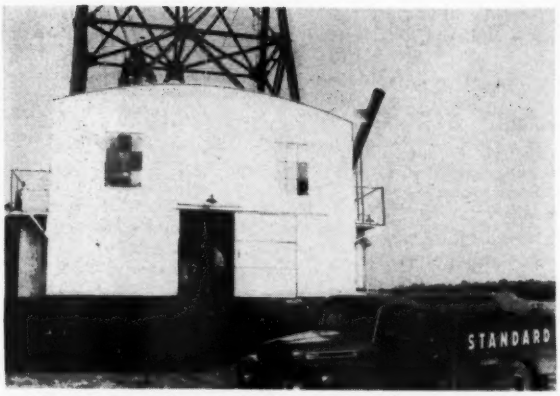
Having received a shipment of drums, you will want to store them properly. Drums prefer inside storage. (Don't put drums next to steam pipes.) If you must store them outside, at least build a shed roof. Failing this, store them on racks, on their sides; or, if upright, tilt them with bungs uppermost to forestall moisture contamination from snow or rain.

Bulk deliveries from tank trucks or railroad-tank cars must be carefully supervised. Delivery lines and pumping equipment (if used) should be clean. Adequate storage tanks, constructed of sheet iron or steel, should be provided. Tanks must have provisions for periodic cleaning and drainage. The suction line for withdrawal of liquids should be several inches above the bottom of the tank to avoid withdrawing moisture and contaminants which settle to the bottom. Moisture, incidentally, comes from condensation of moist air drawn into tanks as the fuel or oil is withdrawn. Inside storage is preferable for petroleum products.

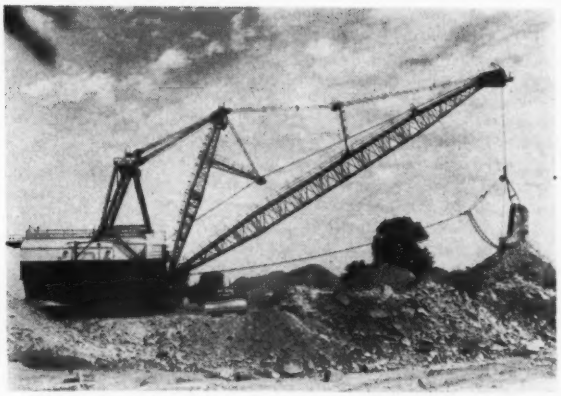
Transferring to Dispsensing Equipment

Getting fuels and lubricants from your storage area to the point of use can introduce further danger from contamination if you're not careful. There are now available many excellent types of equipment for transferring petroleum products to dispensing equipment or to machine sumps, crankcases or fuel tanks.

Petroleum oils, for example, can be pumped by means of transfer pumps directly from drums carried to the machine, or they may be pumped into portable cabinet tanks which are wheeled to the machines to be lubricated. These methods are applicable principally to above-ground machinery such as coal-preparation equipment, mine hoist machinery, conveyor drives, engines, etc. Mobile haulage equipment, both underground and surface (strip mining) types can be driven to convenient central locations for periodic servicing. Mining equipment operating in place can be serviced by the use of mobile lubrication carts or trucks carrying lubricant drums and drum transfer pumps or



Diesel fuel is delivered directly to the dragline at this stripping operation



This walking dragline gets adequate lubrication to keep it on the job

Recommended practices for storing, handling, transferring and applying lubricants are given in this report that emphasizes the importance of preventing lubricant contamination. Special products for tough lubricating jobs are also described

by portable bucket pumps filled from drums. In any event, the transfer equipment must be kept clean and should be tagged for use with one lubricant only. If it is switched from one oil to another, it should be carefully drained and cleaned.

Lubricating greases also quickly pick up harmful contaminants if improperly handled. Greases are most often dispensed from grease guns into pressure-gun fittings on bearings or, in newer equipment, into reservoirs of central greasing systems. The problem is to fill the gun from the grease drum without introducing dust and dirt. Grease drum-loader pumps help do this job by pumping grease directly from drum to gun. Poorest idea is to fill an old coffee can by means of a wooden paddle for carrying to the machinery. Best (and newest) idea is a multi-purpose grease sold in cartridges. The cartridge is easily and quickly loaded into a special gun with no fuss or mess. Possibility of contamination is almost nil.

Petroleum fuels, when supplied to fixed engines, are most often pumped from storage tanks directly to fuel tanks. Portable equipment, such as shovels and draglines in strip mining, are conveniently supplied directly from a tank truck driven to the site.

Dispensing Operation

Again, the emphasis is on cleanliness. In accordance with a carefully planned lubrication schedule, adapted to each piece of machinery to be lubricated, oils and greases are carefully added (or changed, as required). Lubrication jobs may be performed on the spot by the working crew, or by specially trained lubrication experts. In either case, lubrication practices and schedules should be installed and supervised by a maintenance superintendent who knows his business. He can be assisted by recommendations from the equipment manufacturer and from the oil supplier, both of whom take a vital interest in proper lubrication.

Where small amounts of oil are involved, an oil can will probably be used. Since the possibility of contamination is great, instruct your oilers to keep oil cans covered, keep them clean, and to clean off oil fill holes before adding lubricant. Crankcase oils should be changed frequently enough to eliminate contaminants which build up in engine operation (see the recommendations of your engine manufacturer). Use transfer pumps mounted in the oil drum, or mobile cabinet tanks with pumps to handle crankcase oils. Don't use an old pail. Similarly, transmission oils and gear lubricants need periodic changing and the same careful handling. Gear oils pick up water, dirt and metal particles which must be removed to keep down gear wear, and also bearing wear where the gear lubricant also lubricates these.

Grease lubrication by means of pressure guns need not be difficult. Tell your maintenance men to use a different gun for each grease (or use modern multi-purpose greases, for example, the lithium-soap types). Tell them to carefully wipe fittings before filling. Tell them not to overfill (some bearings have relief ports to prevent this). Ball and roller bearings should never be more than ⅓ to ½ filled. Excess grease causes high temperatures and may blow seals.

Mine Lubrication Problems

Not only do most mining operations subject lubricants (and fuels) to severe contamination from dust, dirt and water, they also present other problems. Equipment is typically run for long periods without stopping for maintenance. Greasing and oiling must be done "on the fly." Downtime, whether for lubrication purposes or for maintenance due to lack of proper lubrication, is costly. Add to this the fact that outage of one unit may affect several other units dependent on it for the flow of materials and add greatly to non-productive costs.

Specially trained lubrication personnel are not always available, particularly in smaller mining operations. Reliance must be placed on members of your crews performing the required lubrication once each shift, or at other proper intervals. This means that the maintenance (or lubrication) department must set up lubrication records and schedules for each machine in enough detail so that relatively unskilled workers will know what parts require lubrication (or draining),

what petroleum products to use, and how often to lubricate.

Lubrication records and schedules can be set up for each machine, or group of machines, by consulting with machine manufacturers and with petroleum suppliers. A lubrication record card can list the points requiring service, lubrication intervals and what products to use. These cards can be arranged so that the lubrication jobs to be performed on a particular day will be apparent. Guess work and hit-or-miss lubrication must be eliminated as far as possible. Your maintenance chief or mine lubrication engineer should check continually to see that lubrication is performed as scheduled. He should also check to see that correct lubricant handling practices are followed to eliminate possibility of contamination or misapplication of lubricants.

Engine crankcase drain periods for power equipment are not always easy to determine. While engine manufacturers make general recommendations as to drain periods, actual service conditions are the real determining factors. You will, of course, want to get the maximum benefit from the crankcase oils you are using. At the same time, even the best inhibited (or additive type) oils have a definite service life, after which it might be dangerous to the engine not to drain the used oil and install fresh oil.

Some of the factors which affect determinations of oil drain periods for engines operated in mine service are:

(1) **Exposure** to contamination from dirt and dust, moisture, or fuel dilution.

(2) **Engine operating temperatures**—Engines should be kept as close as possible to recommended operating temperature. Either excess heat or cold adversely affects crankcase oil performance.

(3) **Proper servicing** of both engine air cleaners and crankcase oil filters to maintain their contaminant removal properties.

(4) **Quality of fuels used**—High sulfur fuels may be troublesome, although some of the newer high-detergent oils help control this problem.

(5) **Engine adjustment and maintenance**—Poor adjustment, leaky gaskets, faulty crankcase blowers, other engine troubles all have adverse effects on crankcase oils.

Special Products

Suppliers of petroleum products, such as Standard Oil Co. (Indiana), devote considerable research on mine lubricating problems. The special products they have developed have been remarkably successful in handling difficult mining operations. For example, a lithium soap type multi-purpose grease has proved invaluable in grease-lubricated applications. Its excellent water and heat resistant properties, plus remarkable stability, fit it for a variety of purposes, as its name indicates. It is always helpful to be able to use just one grease for a number of purposes—this reduces inventory, reduces the chance of misapplication and results in less waste and less chance for contamination. This particular grease is now being marketed in individual cartridges which may be easily loaded in a special pressure gun. Cartridges can be taken directly to the point of use and loaded with little or no possibility of contamination.

For applications requiring exceptional resistance to heat and exceptional stability, greases made with a new non-soap organic thickener are being made. These are premium products for the really tough lubricating jobs.

Other applications where lubricants of great stamina are required (mine car wheels, cutters, loaders, mine locomotives and other heavy duty equipment) can be handled by a special line of mine lubricants ranging from a transmission oil to a heavy grease.

Crankcase lubrication, particularly with diesel engines, represents a special problem which has been solved by a series of additive-type oils. These are available in the commonly designated "MIL," Series 1, Series 2 and Series 3 types (representing successive detergent levels). Crankcase oils are now specified with reference to the type of engine service involved (API Service Classifications ML, MM, MS for gasoline engines and DG, DM and DS for diesel engines).

. . . And in Conclusion

Petroleum suppliers like to be faced with the difficult lubrication problems which are, perhaps, typical in the mining industry. They enjoy meeting the challenge with a program of development of superior lubricants. They know they can help solve costly maintenance problems with correct recommendations backed with research and experience developed products.

They ask only that the mine crews and maintenance men exercise due caution to reduce the possibility of lubricant contamination or misapplication. They feel that good lubricants, properly applied, can help you cut maintenance costs.

The diesel engine in this mine locomotive needs periodic lubrication service. Lubrication practices and schedules should be installed and supervised by a qualified maintenance superintendent

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Silicosis Research

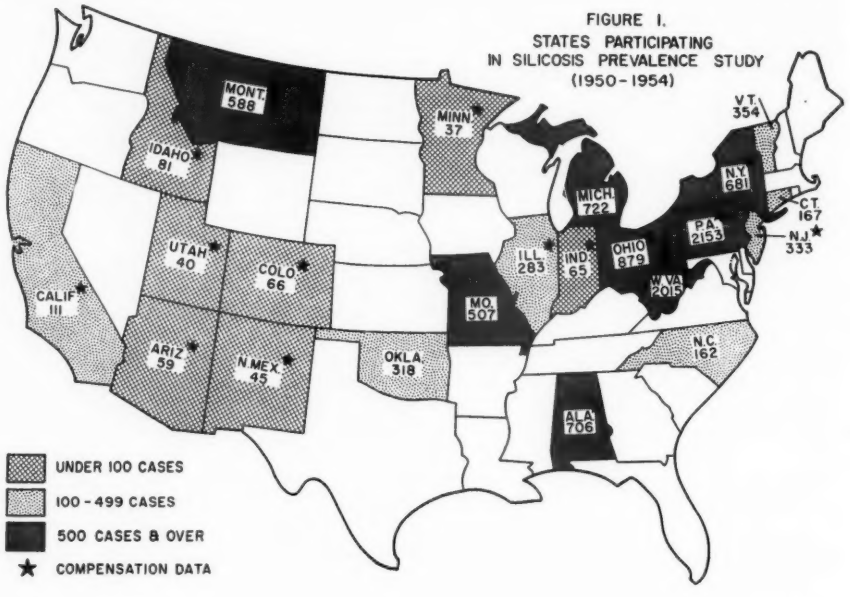

FIGURE 1.
STATES PARTICIPATING
IN SILICOSIS PREVALENCE STUDY
(1950-1954)

Some recent developments in the prevention and control of silicosis, an occupational disease that continues to be a problem of industrial, social, and economic significance

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SILICOSIS means a pathologic condition of the lungs caused by breathing significant amounts of free silica dust over varying periods of time. There are four relevant factors so far as the causative agent is concerned; namely, number of dust particles per unit volume of air, particle size of the dust, mineral composition of the dust, and length of time the worker is exposed to the dust. In this disease there is general replacement of the normal elastic tissue of the lungs by unyielding, inelastic fibrous tissue, which causes shortness of breath, decrease in lung expansion, and in increased susceptibility to tuberculosis.

Results of Early Studies

The Public Health Service and the Bureau of Mines have long been concerned with the silicosis problem. Their interest dates back to 1914 when they made a joint investigation of silicosis in the tri-State area of Oklahoma, Kansas, and Missouri. In the 1920's and 1930's, they carried out a series of investigations in the dusty trades which have contributed basic data both on the pathology of silicosis and on the control of hazardous exposures. These studies helped to define the role of such factors as dust concentration, particle size, composition of the dust, and duration of exposure and led ultimately to the adoption of 5,000,000 particles per cu ft of air as a maximum allowable concentration for crystalline silica dust.

There have been few fundamental changes in the concept of the epidemiology of silicosis since the performance of these field studies of the Public Health Service and the Bureau of Mines and the laboratory investigations at the Saranac Laboratory for the Study of Tuberculosis, Saranac Lake, N. Y. These studies led to the general conclusion that silicosis results from the inhalation of crystalline silica in particulate form for prolonged periods of time and that the rapidity and extent of development are in general directly related to the number of particles in the size ranges which enter the lungs and are retained—namely, those from 0.5 to about 4 microns in diameter. Concentrations of such dust below 5,000,000 particles per cu ft of air are rarely associated with the development of disabling silicosis. Striking reductions in the incidence of silicosis have resulted from acceptance of these principles and their use in the design and follow-up of control measures.

However, despite the enormous amount of research that has been done throughout the world on the subject of silicosis, the nature of the action of the silica particle upon pulmonary tissue is not known; that is, the mechanism by which silica produces fibrosis. Nor is it known why the silicotic is more susceptible to tuberculosis than the normal person.

Are Present Controls Adequate?

The uncertainty in these medical areas carries over into the field of engineering controls, and today we find ourselves taking stock and wondering whether the accepted techniques for the prevention of silicosis are in reality totally adequate.

Twenty years have now elapsed since the introduction of widespread dust-control programs by the larger mining and industrial companies, yet silicosis cases still occur. Are these cases the result of precontrol exposures, in view of the long latent period for the development of silicosis? Are they accounted for by the failure to apply controls universally? Or are they occurring because of the inadequacy of present standards? To help answer these questions, the Public Health Service recently undertook statistical research on the prevalence of silicosis. Only cases diagnosed as

"silicosis" were tabulated. The following data do not include other types of pneumoconiosis diagnosed as being caused by dusts other than free silica.

Prevalence of Silicosis

Covering the five-year period, 1950-'54, the study found 10,362 cases of silicosis that have been compensated or reported in one form or another in the 22 states illustrated in Figure 1. These states were selected because of the availability of information and because it was known that silicosis is or had been a problem in these states. If cases processed by compensation agencies but for various reasons denied benefits are added, the total exceeds 13,000.

Of the 10,362 silicotics recorded during this period, about 20 percent were dead; 50 percent were totally disabled; and 30 percent were still working, seeking work, or of an unknown status.

Because of the difficulties surrounding the gathering of these data and because of the limitations inherent in the records themselves, we have good cause to believe that the 10,362 cases are an underestimate of the actual situation. Nonetheless, one cannot deny that 10,362 cases, limited to 22 states, are a sizable number, even if spread out over a five-year period.

The data reveal that these cases represent primarily an older group, three-fourths of the cases uncovered being in individuals over 50 years of age. This finding, within limitations imposed by the data, supports the current opinion that many of the cases of silicosis coming to light at the present time represents a residue of old cases. However, these data also show that silicosis is occurring among young men with recent exposures.

Associated With Many Industries

Table 1 gives the industry in which the silicotic was employed at the time the case was reported. Since two states did not have this information, the table is an analysis of 10,152 cases from 20 states. This is a numerical distribution of the cases and does not relate the cases to the population at risk. Therefore, the data cannot be used to compare the silicosis hazards between the various industries. You will note that the mining industries produced 6755, or two-thirds, of these cases. Coal mining, including both soft and hard, ranked highest with 4079; metal mining followed with 1637. There were 854 cases for which the type of mining was mixed or was not specified. Drillers, muckers, shovelers, and machinemen were the most commonly mentioned specific occupations. Another 185 cases were associated with the extraction and milling of nonmetallic minerals such as clay, feldspar, and mica, and in tunneling and quarrying operations.

These facts indicate that silicosis is still associated with a wide variety of industries, and, if the occurrence of silicosis among young men can be regarded as a criterion, no industry can take credit for complete dust control.

New Cases

To determine more precisely whether a significant number of new cases are developing among workers entering dusty trades for the first time in the past 20 years, we analyzed 3455 cases in ten states for which reasonably adequate employment histories were obtained. Of this number, 344 workers, or ten percent, allegedly received their entire dust exposure after 1935, sometime during the past 20 years.

The distribution of the 344 cases, by industries, is shown in Table 2. The two groups with the largest proportion of cases receiving total dust exposure in the past 20 years were nonmetallic mineral industries with 32 percent and nonmetallic mining and quarrying with 21 percent. Cases were found with less than five years of exposure; but, in general, the exposure period averaged about 15 years.

Preliminary tabulation of data collected on 2746 cases in 11 states for which tuberculosis was recorded when present, shows that 35 percent also had tuberculosis. It was diagnosed in 33 percent of the 1763 persons who were alive at the time of the latest record. Forty-nine percent of the 983 individuals who had died during the study period were found to have tuberculosis as well as silicosis.

Still a Serious Problem

The conclusion derived from limited statistical study is that silicosis continues to be an occupational disease of considerable importance. From the standpoint of dust control, the silicosis problem appears to be more prevalent in those men that had their initial exposure before 1935. Enough evidence was uncovered to suggest that either the application of dust control measures is not universal or that other factors such as the adequacy of our present standards, the influence of the particle size and the actual toxicity of various forms of silica, are involved. This fact is evident since silicosis is developing among younger men with recent and short exposure to dust. In addition, we must consider that, with less severe exposures, silicosis may take longer to develop than in the past, a possibility that cannot be determined for some years.

The findings also suggest that silicosis is a serious social and economic problem. Over the past five years the number of compensation claims for silicosis has been increasing. Liberalization of compensation laws and improved diagnoses have undoubtedly influenced this situation. Moreover the silicotic is living longer. Medical progress in general and the gradual adoption of preventive control measures, which have minimized the severity of exposures among men continuing in dusty occupations, have probably contributed to the longevity of the silicotic. The result is that the number of older people becoming eligible for benefits through workmen's compensation or other means is rising.

This inquiry into the prevalence of

HENRY N. DOYLE'S service in the field of occupational health has been extensive and varied. Following a five-year association with the Masonite Corp., Laurel, Miss., as research engineer, he entered the Public Health Service in 1941. His first assignment was in the Division of Sanitation at the Alabama State Health Dept. Since then, his assignments in the field of industrial hygiene have been as follows: 1943-45, arsenal survey team; 1946-47, program development with the Florida Health Dept.; 1948-49, Regional Industrial Hygiene Consultant in Denver, Region IX and X; 1949-52, chief, Industrial Hygiene Field Station, Salt Lake City; 1952-54, chief, State Aid Branch, Division of Occupational Health; since 1954, assistant chief, Occupational Health Program, Division of Special Health Services, Public Health Service.

H. N. Doyle

R. H. Flinn

DR. ROBERT H. FLINN has been with the Public Health Service since 1931. From 1936 to 1942, while stationed at the National Institutes of Health, Bethesda, Md., he conducted a series of field investigations. These included studies of lead poisoning and silicosis among West Virginia pottery workers, lead poisoning in storage battery plants, manganese poisoning in ore-crushing mills, anthraco-silicosis in Utah bituminous-coal mines, health hazards among smelter workers, chronic mercurialism among hatters and laboratory workers, and compressed air illness in tunnel construction.

Dr. Flinn also worked with the Maryland State Health Dept. to develop an industrial hygiene program. He holds the Army Commendation Ribbon for his work on industrial health problems during assignment to the Safety and Security Division, Army Ordnance Dept., in 1942-45.

In May 1955 he was appointed chief of the Division of Health of the Bureau of Mines, on a two-year detail from the United States Public Health Service. As chief, Dr. Flinn assists in formulating programs and basic policies with regard to health in the mineral industries and directing research designed to minimize health hazards peculiar to those industries.

silicosis has revealed, among other things, the need for better reporting of facts on diagnosed cases of silicosis, uniform classification of diagnostic terminology, criteria of disability, and standards for the supervised employment of nondisabled silicotics. In the absence of previous prevalence data of any kind on silicosis in the United States, it is hoped that the final report on this study, now being prepared, will provide a base line for future evaluations of the occurrence of silicosis.

Classification of Chest X-Rays

Since it appears that silicosis will continue to be a problem of industrial, social, and economic significance for many years to come, the efforts of medical investigators to prevent and treat this disease assume greater significance.

Twenty years have elapsed since the introduction of widespread dust-control programs by the larger mining and industrial companies, yet silicosis cases still occur

A notable achievement of the past few years has been the development of a system of classification of chest X-rays in pneumoconiosis which is enjoying the interest of industrial physicians, radiologists and pathologists. The system was accepted by the International Conference of Experts on Pneumoconiosis of the International Labor Organization at Sydney, Australia, in 1950 and is presently being used in Great Britain, France, and Germany.

This system permits uniform differentiation of the various stages of silicosis and other dust diseases included among the pneumoconiosis. Thus, the classification of "simple pneumoconiosis" has three defined categories of inincreasing abnormality, based on the appearance of the roentgenograms of the diseased lung. The classification of "complicated pneumoconiosis" has four categories of increasing abnormality of the film.

This development marks a step forward toward the better understanding of the silicosis problem among investigators in this field. The absence of a standard classification has long been a barrier to the communication and comparison of findings among different investigative groups.

It should be noted that a diagnosis of silicosis cannot be made by chest X-ray alone, but this does not detract from the value of the X-ray as a diagnostic aid. All it means is that, on the X-ray film, other conditions may simulate certain stages of silicosis. Thus, siderosis (from inhaling iron oxide), baritosis, and sarcoid and even miliary tuberculosis may sometimes resemble stages of silicosis. Nevertheless, the chest film provides for the diagnosis of silicosis the most valuable evidence we have (other than lung biopsy, which cannot be widely applied). Like other evidence in medicine, it must be considered with the patient's history, physical findings, and laboratory studies before a final diagnosis is attempted. A characteristic chest film in a person who has been exposed to silica is very strong evidence for silicosis. The development of changes in serial films during a period of exposure is particularly convincing. It is quite another thing, however, to estimate from the X-ray film alterations in lung function or pulmonary disability.

Numerous studies have shown that the earliest recognizable form of silicosis, generally classified as simple discrete nodular silicosis, is attended either by no recognizable alterations of function or by very slight ones. It is possible that slight alterations of function are not recognized since, to date, all studies in diseased persons have been made after the disease has become manifest. Thus, we can only compare the lung function measurements of the diseased person with those of the so-called average normal man. Possibly, a study of persons early in life, prior to the development of the disease, with repeated studies when the disease is fully developed, would show some reduction in respiratory function. In the advanced stages of silicosis, known as conglomerate silicosis or progressive massive fibrosis, recognizable alterations of pulmonary function are usually found readily. They include reduction of the maximum breathing capacity and an increase in the residual volume, which changes interfere with full, free inhalation and exhalation. The oxygen ventilation equivalent may also be slightly above normal. Thus, the diseased person may find it necessary to breathe more air per minute than the normal person in response to physical exercise.

Early Detection of Silicosis Susceptibility

An inherent limitation of the use of the X-ray in the prevention of silicosis is that the disease has already started before the symptoms are discernible on the chest film. Another tool is therefore needed to detect those individuals that are more likely to develop silicosis early. Such individuals could then be removed from further dust exposure before irreversible changes occur.

It is possible to measure the volume of air contained in the lungs in their fully expanded state (total volume) and also in the state of being as empty as one can make them by voluntary effort (residual volume), the difference between these two volumes being the stroke value (vital capacity) of the respiratory pump. The maximum rate at which the respiratory apparatus can move air into and out of the lung in repeated cycles (maximum breathing capacity) can also be measured.

A recent study has revealed that spirogram tracings of the three-second timed vital capacity and the maximal breathing capacity are useful screening tests of pulmonary function to detect early function abnormalities, even before subjective or roentgenologic changes are apparent. They have also been demonstrated to be suitable tests for annual or pre-employment examinations to detect susceptible or poor risk individuals who may be exposed to environmental lung irritants in their work. These spirograms are reported to be cheap to run, rapid in measurement, requiring only five minutes, and easy and simple to obtain for permanent records. It is further reported that the reliability of the spirogram data has been well

Table 1—Silicosis Cases by Type of Industry Based on 10,152 Cases in 20 States During 1950-54.

Industry	Number of Cases	Percent of Cases
Mining:		
Coal	4,079	40.2
Metal	1,637	16.1
Mixed and unspecified	854	8.4
Nonmetallic and quarrying	185	1.8
Total—Mining	6,755	66.6
Manufacturing:		
Foundries	1,645	16.2
Other manufacturing	1,159	11.4
Total—Manufacturing	2,804	27.6
All other and not known	593	5.8
Total	10,152	100.0

Table 2—Silicosis Cases Receiving Dust Exposure After 1935, Based on 3455 Cases in 10 States During 1950-54.

Industrial Group	Number of Cases Reported	Cases receiving dust exposure after 1935	
		Number	Percent
Mining:			
Metal	509	80	16
Coal	1,095	77	7
Mixed or unspecified	65	7	11
Nonmetallic and quarrying	146	31	21
Manufacturing:			
Foundries	888	85	10
Other manufacturing	662	56	8
All other, or not known	90	...	...
Total	3,455	344	10

correlated with complete pulmonary function studies on a large series of cases with all degrees of pulmonary function impairment, and a wide spread of values has been shown between the normal and the most abnormal.

Aluminum Therapy

While efforts continue toward the prevention of silicosis through medical and engineering control measures, we must necessarily also be concerned with the development of effective treatment methods. Since 1939, when a group of investigators at the University of Toronto published the results of a series of experiments dealing with the action of fine aluminum particles on the action of silica and their toxic reaction on body tissues, considerable work has been done with aluminum therapy. The Toronto investigators demonstrated that mixtures of quartz and aluminum dust in the inspired air of cage animals did not produce silicotic nodules after a length of exposure several times that required for quartz particles alone; also, that animals exposed alternately to quartz and aluminum particles did not develop silicosis. The effectiveness of aluminum therapy for human beings, however, remains a controversial question, and its use in the United States is limited. Also, its use has not been endorsed by the Councils on Industrial Health and Pharmacy and Chemistry of the American Medical Association who suggested further research. However, at the McIntyre-Saranac Conference of 1955, two American authors reported favorably on its preventive and therapeutic properties, but it is difficult to determine what influence dust control may have had in the reduction of the incidence of silicosis.

Influence of Dust Control

The value of dust control in preventing silicosis has been clearly demonstrated in a recent study by the Public Health Service and the Vermont Department of Health. This study sought to determine the effectiveness of the control measures that had been established as the result of a study of the granite cutting sheds made by the Public Health Service in 1923. This earlier study had revealed a universal occurrence of silicosis in those workers exposed to concentrations above 40,000,000 particles per cu ft, the disease proving almost invariably fatal within a short time after onset. Between the years 1935 and 1937 practically the entire Vermont granite cutting industry adopted dust control measures. A study made during the summer of 1956 indicated that few exposures in the industry exceeded 5,000,000 particles per cu ft. The Vermont Department of Health has provided annual X-ray examinations of the workers since 1935. It is interesting to note that, within the limitations of the X-ray equipment used, not a single case of silicosis has been diagnosed in a granite shed worker whose initial exposure followed the installation of dust controls. This is the only known example of a silicosis producing industry in the United States in which it appears that no new cases of silicosis are developing.

Future Efforts

While various facets of the silicosis problem are under study by different investigators, we must not overlook the importance of reporting cases of this disease, together with other occupational diseases. Only by learning more about where, when, and under what conditions cases of silicosis are occurring, can we effectively direct our efforts to its prevention and control. If the mining industry were to support wholeheartedly and work for the improvement of occupational disease reporting practices it would be making a sizable contribution to the solution of a vexing problem that otherwise will continue for a long time to come. Meanwhile efforts should be made to strengthen the dust control program and to provide adequate medical supervision and periodic physical examinations for our vital mining population.

Bibliography

"Accomplishments in the Epidemiologic Study of Silicosis in the United States." H. N. Doyle, V. M. Trasko, W. M. Gafafer, and S. E. Miller *A.M.A. Archives of Industrial Health*, July 1955, vol. 12, pp. 48-55.

"Occupational Diseases of the Lungs. Recent Trends in Industrial Health." A. J. Lanza. *A.M.A. Archives of Industrial Health*, Mar. 1955, vol. 11, pp. 183-184.

"Some Facts on the Prevalence of Silicosis in the United States." V. M. Trasko. Presented at the 18th Annual Meeting of the American Conference of Governmental Industrial Hygienists, Apr. 23, 1956, Philadelphia, Pa. *(A.M.A. Archives of Industrial Health*, Oct. 1956, vol. 14, pp. 379-386.)

"Classification of Roentgenograms in Pneumoconiosis." C. M. Fletcher. *A.M.A. Archives of Industrial Health*, Jan. 1955, vol. 11, pp. 17-28.

"Functional Abnormalities of Industrial Pulmonary Fibrosis." G. W. Wright. *A.M.A. Archives of Industrial Health*, Mar. 1955, vol. 11, pp. 196-203.

"Clinical Pulmonary Physiology II. Detection of Early Lung Function Changes in Industrial Exposure." H. L. Motley. *Industrial Medicine and Surgery*, June 1953, vol. 22, pp. 262-267.

"Prevention of Silicosis by Metallic Aluminum." J. J. Denny, W. D. Robson and D. A. Irwin. *Canadian Medical Journal*, Apr. 1939, vol. 40, pp. 213-228. Referred to in: "Silicosis. General Considerations and Surveys in the Coeur D'Alene Mining District of Idaho." P. M. Ellis, M. T. Smith, H. E. Bonebrake and L. B. Hunter. *Northwest Medicine*, Dec. 1942, vol. 41, pp. 406-412.

"Aluminum in the Prevention and Treatment of Silicosis." Report of the Council on Industrial Health and Council on Pharmacy and Chemistry. *J.A.M.A.*, Apr. 27, 1946, vol. 130, pp. 1223.

"Present Status of Aluminum in the Therapy and Prophylaxis of Silicosis." Report of Councils on Industrial Health and Pharmacy and Chemistry. *J.A.M.A.*, July 23, 1949, vol. 140, pp. 1024-1029.

"Experiences with the Control of Silicosis in the Ceramic Industry." D. L. Perry. *A.M.A. Archives of Industrial Health*, Sept. 1955, vol. 12, pp. 247-249.

"Experiences with the Control of Silicosis in a Foundry." L. H. Osmond. *A.M.A. Archives of Industrial Health*, Aug. 1955, vol. 12, pp. 221-225.

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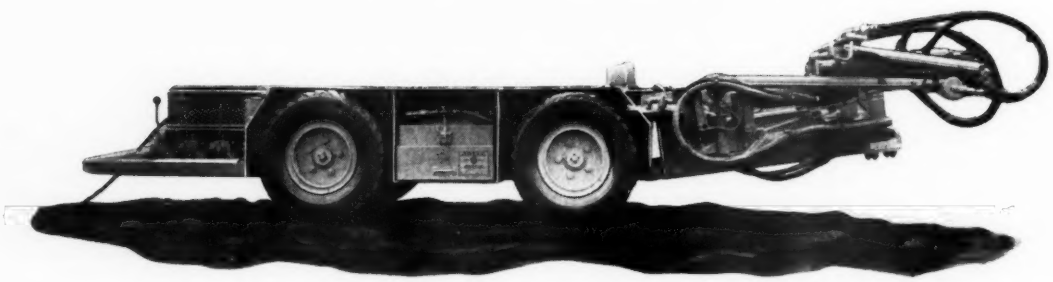

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As Viewed by HARRY L. MOFFETT of the American Mining Congress

A ding-dong battle is under way between Capitol Hill and the Administration over trimming the fantastically high Federal budget for the fiscal year 1958, with the final upshot likely to be a substantial paring of the $71.8 billion requested by the President. The "battle of the budget" came to a head when the House, in an unprecedented action, passed a resolution calling upon the President to outline where cuts could be made, and the President retorted that while he would be glad to be helpful he would not recommend specific cuts.

Following this exchange, the House sliced some $684 million from four appropriation measures, and sharpened its pruning knife preparatory to slashing substantial amounts from the nine remaining funds bills, which include the two biggest of all—Department of Defense and Mutual Security. In the Senate, it is not yet apparent whether the economy drive will maintain full steam. Traditionally, the Senate is more liberal with appropriations. This year, however, grumblings from the hustings over the size of the budget have raised such a din that the upper chamber will critically scan the funds measures as they reach them, and even if the Senate restores the cuts, sizable chunks will probably be slashed by conference committees of the two houses.

Caught in the economy wave are funds for continuation of minerals purchase programs and for minerals and metals stockpiling. The House failed to include the Administration's request for $30 million to continue the minerals purchase programs for tungsten, asbestos, fluorspar and columbium-tantalum in the Urgent Deficiency Appropriation bill. It likewise knocked out another $40 million for this purpose from the regular Interior Department measure. The Senate acted quickly on the deficiency bill and restored the funds for the minerals programs, but House conferees remain adamant and have refused to agree to the Senate action. Pleas by Western States Senators and Congressmen have thus far failed to move the House conferees.

In addition to these funds, the economy drive has resulted in the House chopping out all of the $130 million sought by the Administration for buying strategic and critical materials for the national stockpile. In taking this action, the House heard members of its appropriations committee state that minimum stockpile objectives have been met for 51 of the 72 items on the list, and that $145.7 million is still available from funds appropriated last year to carry on the stockpiling program. It is expected that a drive will be made in the Senate to restore these funds.

Coal Hearings Conclude

The House Interior subcommittee on Coal Research, on March 26, concluded its broad study of the need for additional research in attaining maximum utilization of the Nation's coal reserves. The Committee will now give consideration to numerous recommendations for broadened research programs which were made to it during the hearings which began last fall and were conducted both in Washington and coal producing areas. Committee members expect to recommend legislation which may call for Government-industry research programs along the lines of those now being conducted by the Atomic Energy Commission, and for additional research funds for the U. S. Bureau of Mines.

During the course of the hearings representatives of the American Mining Congress' Coal and Manufacturers Divisions presented extensive testimony, recommending that increased funds be made available for coal research and that the Government undertake a broader program of basic research and leave the conduct of applied research to industry.

Tax Rates Extended

In mid-March the House stamped its approval on a bill extending for another year, from April 1, the existing 52 percent corporate tax rate and the current excise taxes on liquor, cigarettes and automobiles. The measure, it is estimated, will bring in revenues totaling about $3 billion. The House delayed action on the measure, according to reports, in an effort to block expected Senate amendments to reduce the present 30 percent normal tax rate, applying to the first $25,000 of corporate income, to 22 percent and to boost to 53 percent the combined normal and surtax rates on income over $25,000.

As this is written, the Senate Finance Committee is holding hearings on the bill and the amendments described above have been offered in an effort to help small business. The Treasury Department is opposed to tax relief for small business until the budget situation permits a general tax reduction. While indications are that the Committee will reject the amendment, should it be adopted by the Senate by a large margin, it might be accepted by the joint House-Senate Conference Committee.

The Senate Finance Committee is expected to amend the House bill to extend the corporate rates and the excises for a fifteen-month period instead of the year provided in the House bill, and it is understood that House leaders have agreed to accept this change. There is but little doubt that high corporate taxes will remain in force for at least another year.

Labor Investigation Continues

Startling revelations concerning labor union leaders' abuse of power and funds, collusion with underworld elements, and threats to office seekers have stemmed from the investigation of union labor racketeering currently

Washington Highlights

BUDGET: Economy wave under way.
COAL RESEARCH: Hearings conclude.
TAXES: High rates extended.
LABOR LAW: Amendments probable.
PUBLIC LANDS: Withdrawals limited.
TARIFF: House Committee reports.
PHOSPHATE: Lease acreage change sought.
PRICE DISCRIMINATION: "Good faith" defense under attack.
MERGERS: Advance notification proposal gains steam.

being conducted by the select Senate committee, headed by Senator McClellan (Dem., Ark.). It appears that these hearings will run for a long period of time and that further shocking disclosures are in the offing.

Many members of Congress and numerous representatives of the press are of the opinion that the hearings will ultimately lead to revision of existing labor laws, particularly to curb the vast powers of labor leaders.

Outshown by this investigation are other developments in the labor field. Legislation has been introduced which would provide for the establishment of a Federal grants-in-aid industrial safety program for the various states. The President has requested a total of $2.2 million for the Department of Labor to start and operate a program for its first year. The Secretary of Labor, under the legislation, would be authorized to establish Federal safety standards which would have to be met by the states as a condition to receiving Federal funds. Whether or not this legislation would have an effect on the mining industry remains to be seen. No hearings have as yet been scheduled on the proposal.

Revision of the Taft-Hartley Act has also been sought by the Administration. Three proposals have been sent Congress dealing with the construction industry. They call for legalizing so-called "pre-hire" contracts between contractors and unions, now a common practice in the industry, and permission for a group of employers to get together to bargain collectively on a voluntary basis. The third would permit an employer to pay money into trust funds created to finance an apprenticeship or training program. All of these proposals have the stout backing of the construction industry.

Congress also has before it a proposal requiring Federal registration and disclosure of financial reports on employe pension and welfare funds. Under this proposal the Secretary of Labor would be given discretion over the collection and dissemination of all data concerning these funds. Another pending bill would give the Securities and Exchange Commission control of welfare and pension plans.

Whether or not Congress takes any action on these proposals is a question. The disclosures as to union racketeering could well result in action on the measures dealing with welfare funds, while agreement as to the construction amendments could come at any time.

Meanwhile, hearings have been held in both the House and Senate on a number of bills which would extend coverage of the minimum wage provisions of the Fair Labor Standards Act to employes of businesses which annually purchase more than $1 million of goods in interstate commerce; but the fate of these measures is in doubt.

Land Withdrawals Limited

Congress is making some headway on demands from the mining, stockraising, and other industries, and from conservationists that military land withdrawals be checked. The House Interior Committee has sent to the House floor a bill which would require Congressional approval of any withdrawal of public lands for military use which exceeds 5000 acres. Extensive hearings were held on this proposal, after which the Committee drew up the bill. It also requires that any application filed for a withdrawal or reservation of public lands for defense purposes involving more than the 5000 acres shall set forth a description of the areas involved, the land and water acreage, the purpose of the withdrawal and its duration, and its effect upon multiple use of the area.

The mining industry, both through the American Mining Congress and the Western Governors Mining Advisory Council, had complained that the military had withdrawn huge areas in the West and prevented mining locations on them.

Tariff Study Report

A House subcommittee on Customs, Tariffs, and Reciprocal Trade Agreements has submitted a report on the hearings held since last fall. No recommendations were made by the group.

The Committee did point out that the "escape clause," under which domestic industries can seek relief from tariff concessions, commanded more attention during the hearings than any other aspect of the tariff laws. On the one hand it is argued that the escape clause should be applied to afford "permanent and adequate" tariff and/or quota protection for all domestic industries to the extent necessary to avoid injury as a result of imports; on the other hand, it is contended that the escape clause should be applied only in order to apply temporary relief to ease the adjustment of domestic industries to import competition. The report said that these views are deserving of further study and consideration.

The Committee plans to carry on its study of foreign trade problems for another two years, and will devote its attention to the use of quotas to regulate imports, wage differentials between the United States and competing foreign companies, administration of the trade agreements program, and trade and payment restrictions being practiced by foreign nations.

The Committee report also expressed the opinion that the Administration's request for U. S. participation in the Organization for Trade Cooperation (OTC) faces a "rough road ahead" in Congress.

Phosphate Leasing Studied

A Senate Interior Subcommittee on Minerals, Materials and Fuels held a one-day hearing on March 20 on a measure which would remove a provision in existing law which limits an individual or company to holding a maximum of 5120 acres of phosphate-bearing public lands under lease in any one state. Under present law a maximum of 10,240 acres may be held under phosphate lease on public lands throughout the United States and this would not be changed by the pending measure.

Strong support for the measure came from a large number of phosphate producers, the American Mining Congress, Western State mining organizations, the Bureau of the Budget and the Department of the Interior.

Witnesses before the Committee made it quite clear that the present restriction as to acreage within a single state would deter expansion of the phosphate industry in the West, and that allowance of the full 10,240 acres within one state would not result in any monopoly. They also made it plain that phosphate producers now operating on the public domain practice sound conservation measures in extracting the ore; that present leases require Federal inspection of mining, safety and conservation practices, and that failure to live up to the requirements of the leases would result in loss of the property. It was emphasized that the present state acreage limitation discourages new development.

Tenor of the hearing was such as to indicate that the Senate subcommittee and its parent Interior Committee will promptly report the measure favorably to the Senate. Last year the upper chamber unanimously approved a similar bill but it died in the House Interior Committee when the session ended.

Price Discrimination Legislation

Hearings are currently being held by a Senate Judiciary subcommittee on a bill which would amend the Robinson-Patman Act to severely limit the right of a seller to meet in good faith the lower price of a competitor. This measure would eliminate the "good faith defense" now provided a seller and would cloud present practices involving freight absorption.

A similar bill flashed through the House last year but was stymied in the Senate because of an unusual parliamentary situation at the close of the session.

Tremendous opposition from all types of American industry has been evidenced toward the pending bill. More than 250 persons have requested

(Continued on page 142)

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AMC Personals

C. Jay Parkinson, vice-president of Anaconda Aluminum Co., has been appointed general counsel of The Anaconda Co., the parent organization.

Parkinson will continue also to serve as a vice-president and director of the Anaconda Aluminum Co. Since 1941 Parkinson has been a counsel for Anaconda, and for some of its subsidiaries and affiliates. He is a native of Salt Lake City, and has been actively engaged in the practice of law in the mining field since 1939.

W. P. Young, associated with the Bell and Zoller Coal Co. since 1921, has retired as president of the operating division and as a director of the company. Young became operating division president in 1942.

Cerro de Pasco Corp. (Delaware) has named **C. D. Clarke** to the post of assistant to the manager of operations—mining, and **R. M. Humphreys** to succeed Clarke as superintendent of the corporation's Cerro de Pasco mine.

Clarke began his mining career following graduation from the University of Southern California in 1932. He served successively with mining companies in Arizona, California, the Philippines and Bolivia before becoming associated with Cerro de Pasco's Peruvian operations in 1950.

Humphreys, a 1936 graduate of the School of Mines of the University of Idaho, joined Cerro de Pasco in 1950 and was superintendent of the corporation's Morococha mine prior to his present appointment.

Southwestern Portland Cement Co. has announced the retirement of **W. R. Blair,** vice-president and manager, and **T. K. Partridge,** vice-president in charge of sales. At the same time the company announced the election of **M. A. Koffman** as senior vice-president; **Robert H. Fielding** as vice-president and treasurer; **Felix S. McGinnis, Jr.** as vice-president and secretary; **William C. Brophy** as vice-president for marketing, and **F. T. Sheets, Jr.** as vice-president for manufacturing.

Phelps Dodge Corp. has revealed that **Leo M. Abell** is now concentrator superintendent of its Morenci Branch, succeeding **J. E. Papin** who retired January 1. Abell was formerly research engineer.

At a meeting of the Board of Directors of Ayrshire Collieries Corp., **Norman E. Kelb** was elected president of the corporation. He succeeds **James W. Morgan,** who died February 1, 1957.

Ayrshire Collieries Corp. is a large operator of strip and deep mines in Indiana, Illinois and Kentucky.

N. E. Kelb

Kelb has been a member of the Board of Directors of Ayrshire Collieries and of Republic Coal & Coke Co., of Chicago, for the last six years. He has been connected with the production of coal and the production and sale of construction materials for many years. He is also president of Eel River Mining Co., Inc., High Point Oil Co., Cumberland Quarries, Inc., and Refiners Transport, Inc., all of Indianapolis. He is now serving his second term as president of the National Crushed Stone Association.

J. H. Buehler, who has been in active charge of mining operations for Bristol Silver Mines Co. in Nevada's Pioche district since 1924, has retired as general manager. He will remain in an advisory capacity.

Byron S. Hardie, exploration geologist for American Smelting & Refining Co. succeeds Buehler as general manager.

Peabody Coal Co. announces the appointment of **Eugene E. Quenon** as director of safety. Quenon has been connected with the Bureau of Mines since 1929, and prior to his new post was District Health and Safety Supervisor of District E, Vincennes, Ind., for the Bureau. Quenon will be located in the St. Louis office of Peabody and will be in charge of all safety, including strip and underground mines.

The election of **J. B. Haffner** as a member of the board of directors of Federal Uranium Corp. has been announced. Haffner was general manager of Bunker Hill Co. for 14 years and was president of the firm from 1954 until his retirement in 1955.

At the same time Federal Uranium announced that **Arthur W. Griffith** has been named superintendent of milling and chief metallurgist for the company. He will supervise milling operations at gold, silver and lead properties presently held by Federal, as well as investigate milling facilities of properties to be examined for possible acquisition.

The Division of Mines and Geology of the State of Washington, has announced the retirement of **Sheldon L. Glover** from 40 years of professional geologic work. He has been supervisor of the Division for the past 12 years, was supervisor of the Division of Mines and Mining from 1941 to 1945, and was assistant supervisor of the predecessor agency, the Division of Geology, from 1934 to 1941.

Robert F. Pettit has been appointed chief engineer of the American Smelting & Refining Company's northwest mining department. Formerly Pettit was associate professor of mining engineering at the Missouri School of Mines.

Vincent O'Leary, former mine superintendent Mountain Con mine and acting assistant general superintendent of mines for Anaconda, has been appointed assistant general superintendent of mines. **John Suttie,** former mine foreman and acting mine superintendent at the Mountain Con, has been promoted to superintendent of the Mountain Con mine. **Dan Griffin,** who has been acting mine superintendent of the Lexington mine, is now superintendent of the Lexington.

The appointment of **Ralph D. Williams** as vice-president and **William R. Whitener** as sales manager has been announced by R. D. Bradford, president of Lake Asbestos of Quebec Limited, a subsidiary of American Smelting and Refining Co.

AS&R is spending $32,000,000 to develop asbestos deposits at Black Lake in Quebec. Lake Asbestos of Quebec, the producing and distributing subsidiary, will be marketing asbestos fibre by 1958. Production is expected to exceed 100,000 tons per year.

R. D. Williams

W. R. Whitener

The New Jersey Zinc Co. has announced three organization changes.

R. L. Sayrs is now superintendent of the Flat Gap operation at Treadway, Tenn. **A. C. Savage** has been made mine chief of the Jefferson City, Tenn., property. **K. R. Winslow** will serve as mine chief of the Austinville, Va., property.

Robert M. Haldeman, general manager of Braden Copper Co., a subsidiary of Kennecott Copper Corp., has been appointed vice-president of Braden. Haldeman is chief executive of the company in Chile with offices in Santiago.

Haldeman joined the Braden organization in 1941. In 1951, he was appointed assistant to the general manager and the following year was named general superintendent. He advanced to general manager in 1954.

Standard Uranium Corp. has announced that **Russell Woods**, mine superintendent, has been promoted to assistant general manager of the company.

The Anaconda Co. has announced several personnel changes at its Montana operations.

Edward D. Tierney has been appointed general superintendent of the Great Falls Reduction Department, succeeding the late **Clarence V. Saylor**. Tierney has been general superintendent of plants for the Chile Exploration Co. at Chuquicatmata, Chile.

F. A. Linforth, assistant to the vice-president, retired March 1 after more than 50 years of service to the organization. Linforth's precisely-made relief and engineering and geological models have won him wide acclaim over the years.

Stanley W. McDougall, manager of mines for The Bunker Hill Co., has taken on the additional responsibility of director of mine operations for Pend Oreille Mines & Metals Co. Bunker Hill has a substantial stock interest in Pend Oreille.

G. T. Rummel has been elected president of the Colorado Mining Association. Other officers named for the current year are: **Max W. Bowen**, first vice-president; **W. E. Burleson**, second vice-president; **D. W. Viles**, third vice-president; Frank Coolbaugh, fourth vice-president, and **John Hill**, fifth vice-president.

John A. Featherstone, formerly vice-president of Golconda Lead Mines, Wallace, Idaho, has been elected president and general manager succeeding his father, the late Judge **A. H. Featherstone.**

Wallace G. Woolf, vice-president in charge of Kellogg Operations for The Bunker Hill Co., has announced the appointment of **A. Y. Bethune** as manager of metallurgy. Bethune, who has been Zinc Plant superintendent since 1954, succeeds **Harold E. Lee** who was recently promoted to the new position of vice-president in charge of Research and Development.

To succeed Bethune as Zinc Plant superintendent, Woolf announced the promotion of **Walter Schmittroth.** Schmittroth has been the number two man at the Zinc Plant since 1955.

William B. Hall, general manager, has been elected president and general manager of Vitro Uranium Co., division of Vitro Corporation of America.

Richard C. Cole, assistant general manager, has been elected vice-president of the uranium division.

James V. Thompson has been named mining engineer for development for Kaiser Engineers. He will work on development of new projects involving consultation, studies and design engineering for Kaiser Engineers' mineral projects throughout the world. The firm is a division of Henry J. Kaiser Co.

Thompson has been with the engineering division of the Humphreys Investment Co. since 1948 and was responsible for exploration, research, development and sales for the various Humphreys companies.

The election of **Claude O. Stephens** as president of the Texas Gulf Sulphur Co. has been announced by the board of directors. Stephens succeeds **Fred M. Nelson**, who was elected chairman

C. O. Stephens

F. M. Nelson

and who will continue as chief executive officer. **Walter H. Aldridge**, chairman since 1951, was named chairman emeritus and will continue as a director.

Stephens joined the company in 1932 and was appointed manager of the gas department in 1951. He was elected a vice-president in 1952 and became a director in 1956.

Nelson has been with the company since 1927. He was field manager in charge of sulphur production from 1929 to 1945, when he became executive assistant. He was elected president in 1951.

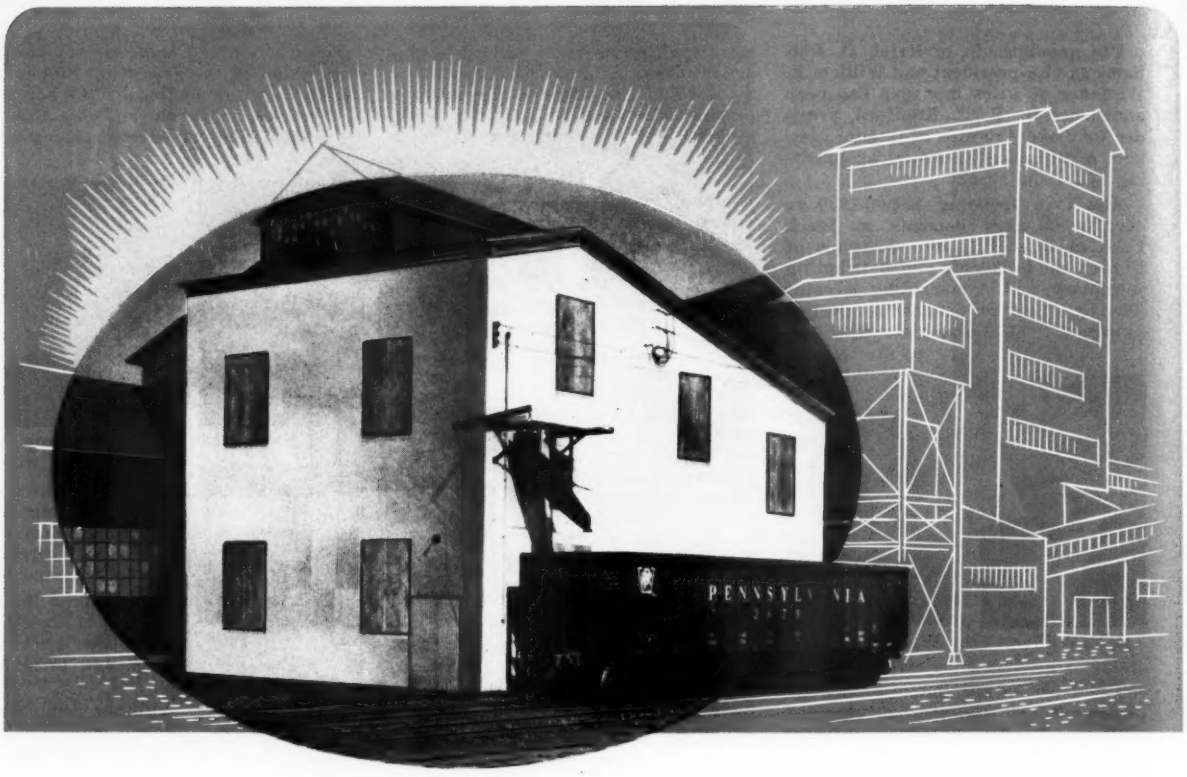
Dr. Frederick C. Kruger has been appointed chief geologist for International Minerals and Chemical Corp., Chicago, Ill. He will join the staff of International's Mining and Exploration Department and will be primarily responsible for geological appraisals and the evaluation of new mineral discoveries.

From 1941 to 1949 Kruger was assistant chief geologist for the Cerro de Pasco Corp. at La Oroya, Peru. For the past five years he has been assistant chief geologist for Reynolds Metals Co. at Little Rock, Ark.

—Obituaries—

James C. Grymes, 96, pioneer West Virginia coal mine operator, died February 1 in Charleston, W. Va.

Mr. Grymes founded the Wake Forest Mining Co. He operated this company as president and general manager until 1926 when he retired.



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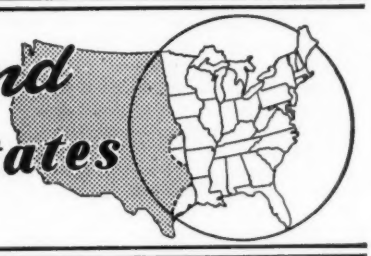
NEWS and VIEWS

Eastern and Central states



Win Safety Contest

Eastern Gas & Fuel Associates and New River & Pocahontas Consolidated Coal Co. mines triumphed in the 1956 accident prevention contest conducted by the Beckley, W. Va., Council of the Holmes Safety Association. Stotesbury No. 8 and the Eccles No. 6 mines of Eastern Gas & Fuel and Layland mine of New River & Pocahontas were awarded plaques for their safety records in their respective mine groupings.

The statistics for the council's 15 mines showed 324 lost-time accidents and 10 fatalities in 6,039,834 man-hours for a frequency rate of 55.3 mishaps per million man-hours.

To Explore Bolivia's Mineral Wealth

Ventures Limited of Canada and Vitro Minerals Corp., Salt Lake City and New York, have announced formation of a jointly owned company, Bolivex Corp., to explore the untapped mineral wealth of Bolivia. The new corporation is expected to commence field work this spring after arrangements are completed with Bolivia government officials.

Vitro Minerals, a joint affiliate of Vitro Corporation of America and Rochester and Pittsburgh Coal Co., is actively developing uranium mining properties in Utah, Wyoming and Colorado.

Ventures, Ltd., an internationally known mining concern, is engaged in mining operations in the United States, Canada, Europe, Africa, South America and Australia through subsidiary and associate companies.

St. Joe Finds Iron Ore

Reports of a discovery of a major iron ore deposit in Missouri by the St. Joseph Lead Co. have been confirmed. According to the company's annual report, three centers of iron ore deposition have been discovered about 40 miles northwest of Bonne Terre, Mo., as the result of an airborne magnetometer survey in 1951 and subsequent exploration work. One of these, known locally as the Pea Ridge Deposit, has been drilled sufficiently to indicate the probability of a large tonnage of commercial grade ore at a depth of between 1400 and 3000 ft below the surface.

The other two bodies in the same general area have been drilled less extensively but are considered of definite interest.

The report went on to say that, in February of this year, Bethlehem Steel Corp. approached St. Joe with a proposal to form a joint 50-50 company to exploit the Pea Ridge deposit. Under the suggested arrangement, St. Joe would take the major responsibility of operating the mine and Bethlehem would supply the major financing, their knowledge of iron ore beneficiation, and a market for the product. St. Joe is actively studying this proposal on the basis of an annual output f 2,000,000 tons.

Five years of construction and mine preparation would probably be necessary for such a large scale enterprise before reaching the production stage.

New Marketing Arrangement

Crozer Coal & Land Co., Page Coal & Coke Co., and Nassau Coal Co., have made known that Pittsburgh Consolidation Coal Co. is now sales agent for the marketing of their coal. Pittsburgh Consol has been the sales agent for a number of years for coal mined from the Turkey Gap mine of Crozer Coal & Land Co. It will now become sales agent for all of the mines of all three companies.

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Mardi Gras Reception for A.I.M.E., Grover Holt Becomes President

New Orleans was the site of the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers, February 24-28. Some 3000 engineers from the various mineral industries were on hand to attend the technical sessions, enjoy the attractions of the French quarter and take in the convention social activities.

Carl E. Reistle, Jr., 1956 president of the institute, presided over the convention, turning the gavel over to Grover J. Holt, the new president, at the annual banquet. Holt is general manager of Cleveland Cliffs Iron Co. and a longtime member of A.I.M.E. who has been particularly active in the Minerals Beneficiation Division.

Among the other honors conferred was the presentation of the Hoover medal to Herbert Hoover, Jr. for pre-eminent service in advancement of the well-being of mankind. Russell B. Caples, vice-president in charge of metallurgical operations of The Anaconda Company, received the James Douglas gold medal for distinguished achievement in the field of nonferrous metallurgy.

The Charles F. Rand medal went to Andrew Fletcher for his achievements in mining administration. Fletcher, president of the St. Joseph Lead Co., is a past president of A.I.M.E. and a director and chairman of the Finance Committee of the American Mining Congress. Antoine Marc Gaudin, Richards Professor of mineral engineering at Massachusetts Institute of Technology received the Robert H. Richards award for his contributions as a scientist, educator, author, and leader in the development of recovery techniques for low-grade uranium ores.

Joseph L. Gillson delivered the Jackling lecture and received the Daniel C. Jackling award for significant contributions to technical progress in mining, geology and geophysics. The Robert Peele memorial award recognizing achievement in authorship in the fields of mining, geology and geophysics was awarded to Louis A. Panek, mining methods research engineer with the Applied Physics Laboratory, U. S. Bureau of Mines, for his paper, "Analysis of Roof Bolting Systems Based on Model Studies."

The technical sessions of the various divisions were well attended and included excellent presentations in all phases of the minerals professions. It was truly a successful meeting which mining men found highly enjoyable and informative.

POSITIONS OPEN

The expansion program of the United States Bureau of Mines creates opportunities in Government career positions. The Bureau is seeking metallurgists, ore dressers, engineers and qualified specialists in other technologies. Vacancies range from GS-5 ($4,480 a year) to GS-12 ($7,570 a year) and include some administrative jobs. Applications may be directed to the Bureau's headquarters in Washington, D. C.

Johnstown Builds Cleaning Plant

The Johnstown Coal & Coke Co. has announced the purchase of a new coal cleaning plant for its Crichton No. 5 mine in Webster County, W. Va. The mine is operated by Williams River Coal Co., an affiliate of Johnstown.

The Williams River plant will have an over-all capacity of 320 tph, guaranteeing ample plant capacity to prepare the daily production of 3000 tons at the mine. It will be a Roberts and Schaefer air cleaning plant and will treat the ⅜-by-0 in. fraction, heretofore not cleaned.

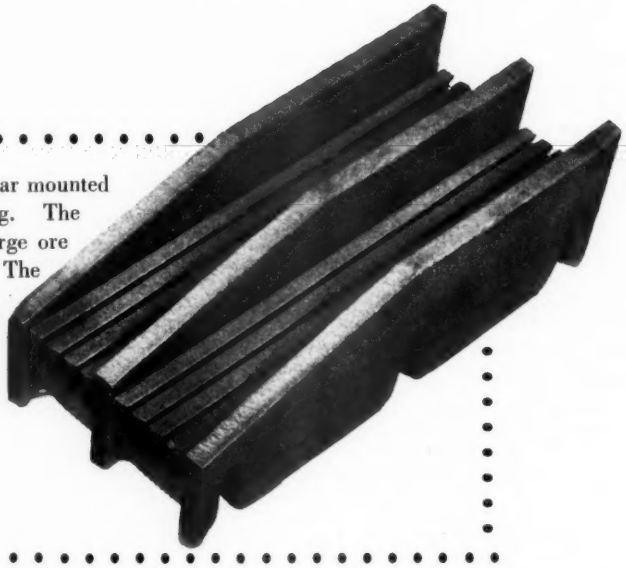
The new plant, together with other improvements and additional underground equipment changes planned during 1957 for the mine, will involve expenditures of approximately $1,000,000.

BIG BOULDERS HIT THE SKIDS!

. . . not the screen!

There's nothing that can compare to Hendrick skid bar mounted Wedge Slot Screens for heavy-duty metal mining. The rugged skid bars protect wedge slot profiles from large ore chunks . . . greatly reduce wear caused by abrasion. The C-12 profile bars have thick parallel head flanges to maintain uniformity of openings. Designed for long service life and excellent draining, C-12 bars are $1\frac{2}{64}$" wide . . . slots run the whole length of the screen. Write for more information.

VISIT BOOTH 1509
At the Coal Show



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Join AMC Staff

Two new men have joined the staff of the American Mining Congress — **Philip M. De Vany** and **Jack E. Goodman.**

A native of South Dakota, De Vany brings to the Mining Congress years of experience on Capitol Hill and in association work. He is a graduate of the University of Minnesota with a major in journalism and has attended South Dakota University and South Dakota State College.

Prior to joining the AMC staff, he was administrative assistant to Congressman Harold O. Lovre of South Dakota. His work included the study and analysis of legislation, preparation of bills for introduction, and speech writing. He was in complete charge of the administration of the office. Other experience includes serving as secretary of the Greater South Dakota Association—the objective of this association being to assist in the establishment and preservation of a healthy climate for business and industry in that state. De Vany has also held the position of manager of the *Vermillion Plain Talk,* a weekly newspaper in Vermillion, S. D.

During World II he served with the Army. Military assignments were in the fields of procurement, disposal of surplus property, military instruction of cadets and the maintenance of Reserve Officer Training Corps supply records.

Goodman is the new production manager of MINING CONGRESS JOURNAL and has a varied background in publication.

His first three years in the field were as an editorial and production employe with magazine and book publishers in New England and Ohio. Then came three years of editing official publications for Oklahoma A & M College, Stillwater, and later fund-raising for George Washington University's Patent Foundation.

Goodman followed this with two years of production and contact work for an advertising agency handling National Guard public information, an assignment which gained him the chief editorship of Educational Publications for the U. S. Armed Forces Institute, Madison, Wis.

His education includes a journalism degree from Ohio State University, Columbus, Ohio, and a master's degree from Ohio University, Athens.

Ore Tunnel Completed

A 2½-mile tunnel under the New River in Virginia has just been completed by the Bertha Mineral Division of the New Jersey Zinc Co. The tunnel connects the Ivanhoe and Austinville operations of the company.

The principal function of the tunnel is to provide passage for zinc ores from the Ivanhoe mine to the Austinville mill. It will also be used for the transportation of men, materials and supplies between the two points. Diesel haulage will be used.

HAPPY EVENT!
The SuperDuty® Table Has Twins

Exhibited at the Coal Show for the first time anywhere, the new CONCENCO® "77" DIAGONAL-DECK® Coal Table has a washing capacity exactly double that of the above illustrated SuperDuty older #7 table.

The revolutionary new construction not only has two identical decks operating in unison from one head motion, but cable suspension of the decks virtually eliminates impact to the building, thus permitting smaller, lighter housing structures that materially reduce new plant cost.

Already proven by months of 3-shift operation, the "77" carries exactly the same mechanical and operating guarantees that cover the almost universally employed SuperDuty No. 7 Table.

Send for Bulletin.

See the New
CONCENCO "77" DIAGONAL-DECK
Coal Washing Table at
American Mining Congress
COAL SHOW BOOTH No. 2110

THE DEISTER★
CONCENTRATOR
COMPANY
CONCENCO PRODUCTS

★ *The ORIGINAL Deister Company* ★ *Inc. 1906*
917 Glasgow Ave. • Fort Wayne, Ind., U.S.A.

Railroad Plans Coal Pier

A new coal pier costing $8,000,000 is being planned for Newport News, Va., by Chesapeake and Ohio Railway.

The structure will be 1254 ft long and 120 ft wide and would extend 217 ft channelward of the established pierhead line. A barge drill rig will make two exploratory borings in the river channelward of the pierhead line at the site of the proposed pier.

Company Saves on Fly Ash

Fly ash, the residue of the pulverized coal used in power plant boilers, may be turned into an asset instead of a liability to power companies if current experiments prove conclusive. The product is becoming an increasingly important material in the construction field.

According to Sherman Knapp, president of Connecticut Power & Light Co., fly ash can be used to make a good cinder pellet for use in the manufacture of cinder building blocks; as a displacement for cement, up to around 20 percent, in concrete; or as a road-building material. Mixed with dirt and lime and sprinkled with water, it will result in a hard surface on which asphalt can be placed.

Knapp says that it cost his company $100,000 a year to remove 100,000 tons of fly ash from one plant and that most companies have been so busy carrying on their expansion programs that they have not taken time to promote the fly ash by-product.

Announces New Degree

The Department of Geological Sciences, McGill University, Montreal, Quebec, is offering a new two-year sequence of courses leading to a degree of Master of Science (Applied) in Mineral Exploration. This degree is designed to provide advanced professional training. New discoveries and techniques in geology, mining, metallurgy, physics, and chemistry reportedly have made this new sequence desirable in order to provide adequate training for students entering the mineral exploration field. Legal and financial aspects of mineral exploration are also touched upon.

Lillybrook Buys Reserves

R. B. Williamson, president of the Lillybrook Coal Co., in West Virginia, has recently announced the purchase of Raleigh County's (W. Va.) largest single reserves of Pocahontas seam coal. The purchase was made from the Pemberton Coal & Coke Co.

The purchase included the real estate, leasehold estate, mining plant and equipment owned by Pemberton, and it is estimated that more than 20,000,000 tons of coal are in Pocahontas No. 3 and 4 seams located on the property. Lillybrook is a subsidiary of the Pittston Co.

An Announcement

Fairmont Machinery Company, for 60 years designer and builder of complete cleaning plants, is now the exclusive manufacturer and sales agent for Chance Cones in the United States.

Designed to economically and accurately size and clean coal, the system employs the widely known and highly regarded Chance Sand Flotation Process . . . a process which recovers almost 100% of salable coal.

This addition marks another step in Fairmont's effort to improve and enhance the Company's service to the coal industry. Fairmont engineers are ready to help with present and future Chance plants—call, write or

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AMERICAN MINING CONGRESS
MAY 13-16 — CLEVELAND

FAIRMONT
MACHINERY COMPANY
FAIRMONT, WEST VIRGINIA

DESIGNERS AND CONSTRUCTORS OF COMPLETE COAL PREPARATION PLANTS USING BOTH WET AND DRY CLEANING, CENTRIFUGAL AND THERMAL DRYING.

Shaft Rehabilitation Progresses

Shaft rehabilitation at the Osceola No. 6 shaft of Calumet and Hecla's underground copper mine near Calumet, Mich., has reached a point below the 43rd level, company officials announced recently. The bottom submersible pump in No. 6 shaft was pulled to the surface on January 29.

The Osceola mine has been the scene of one of the largest mine unwatering projects ever undertaken and involved the pumping of some nine billion gallons of water. Actual copper mining operations were begun in 1955 by the Calumet Division in the Osceola No. 13 shaft after unwatering had been completed.

Both of the mines had been closed down since 1931.

To Mine Canadian Rock Salt

Dominion Rock Salt Co., Ltd., a newly incorporated subsidiary of Dominion Tar & Chemical Co., Ltd., has announced that a long-term lease has been negotiated with the federal government for the salt rights to a substantial acreage under Goderich Harbor, Ontario. The mine shaft and buildings will be located on a 12-acre site.

Exploratory work undertaken by the company has been completed. Eight holes about ¼ mile apart have been drilled and a 70-ft bed of salt has been proven for an estimated 50,000,000 tons of salt. It is expected that sinking of an 1800-ft shaft will be started this spring.

Due to the seasonal demand for salt, mine capacity will be much in excess of current daily requirements. Facilities being provided will allow for the mining, processing and daily shipping of 5000 tons.

New Zirconium Plant Planned

The Mallory-Sharon Corp. of Niles, Ohio, and the National Distillers Products Corp., recently announced combined plans to build a zirconium plant on the shores of Lake Erie in Ashtabula, Ohio. The company formed will be known as Reactive Metals, Inc., and will be engaged in the melting of zirconium and its alloys and the manufacture of certain zirconium mill products.

The new company's production later may be expanded to include other metals of value in the atomic energy program such as hafnium, columbium and thorium. The plant will be operated independently of Mallory-Sharon's present activities in the field of titanium and National Distillers manufacturing of titanium and zirconium sponge.

CLEVELAND MINING NEWS

EXTRA

EXTRA

MAY 13-16

COMPTON TO DISPLAY NEW MINING EQUIPMENT IN BOOTH 1756 AMERICAN MINING CONGRESS

Compton, Inc.

ORIGINATORS OF COMPTON LUMP RECOVERY HEADS

CLARKSBURG, WEST VIRGINIA

Wheels of Government

(Continued from page 132)

time to appear before the Committee, and the hearings which were scheduled to be kept brief will probably be stretched out.

The American Mining Congress strongly opposed the adoption of the bill. AMC executive vice-president Julian D. Conover has told the Committee that approval of the measure would throw doubt and uncertainty into a broad field of lawful and long-accepted pricing practices which actually insure competition and thus inure to the benefit of the consumer. He said that under the bill the "good faith defense," now provided by law for alleged price discriminations, would be limited to those cases where the seller could prove that a price reduction did not substantially lessen competition or tend to create a monopoly "in any line of commerce, in any section of the country." He pointed out that elimination of this defense might well make it difficult, if not impossible, for companies producing such basic products as cement, coal, steel and other mineral commodities to meet a competitor's bona fide lower price without running the risk of violating the law. He said that the bill would thus stifle legitimate competition, contrary to the principles of the American free enterprise system.

Conover emphasized that the measure also poses a question as to the effect it may have on freight absorption, since there is serious doubt now as to the meaning of "the law" applicable to freight absorption. He said Supreme Court decisions seem to indicate that "the law" as to freight absorption is whatever the Federal Trade Commission may determine it to be, pointing out that the make-up of the FTC changes from time to time and that "the law" may likewise be changed from time to time, creating serious uncertainty for mineral producers.

New Merger Law Sought

Measures to require advance notification to the Attorney General and the Federal Trade Commission of corporate mergers or acquisitions were subject to extensive hearings before a House Judiciary subcommittee last month.

Similar legislation was considered at the last session of Congress but failed of passage in the last days of that session.

The Administration has gone all out for a pre-merger notification law at this session and it is expected that such a law will be enacted by the present Congress. During the opening days of the hearings, Attorney General Brownell took the position that such a law was a necessity to provide more even-handed enforcement of the antitrust laws. He was supported by officials of the Federal Trade Commission, the Small Business Administration and the Commerce Department.

A number of nongovernment witnesses from industries already under some form of Government regulation —such as railroads, airlines and truckers—asked the committee to exempt them from any requirement of pre-merger notification.

Representatives of the coal industry urged the Committee to amend the bill to provide an exemption which would permit that industry to acquire its "stock in trade"—coal lands—free from Government interference by making the proposed law inapplicable to the acquisition of necessary coal reserves. Similarly, the American Mining Congress urged the Committee to exempt acquisitions of undeveloped or partially developed mineral or mining properties. The members of the Committee expressed the view that the mining industries had a peculiar problem which should be carefully handled in writing a pre-merger notification law, and asked counsel for the Mining Congress and the National Coal Association to get together with the Committee staff in the endeavor to draft suitable amendments.

Salt Firm Purchase

Diamond Crystal Salt Co., with plants in Akron and St. Clair, Mich., has acquired controlling interest in Jefferson Island Salt Co., largest salt producer in the South. Jefferson Island, with home offices in Louisville, Ky., has a plant and mine at Jefferson Island, La., near New Iberia. The Southern firm will be operated as an independent division of Diamond Crystal.

J. Lyle Bayless, Jr., Jefferson Island president, will become a director of Diamond Crystal and a consultant on Jefferson Island product sales.

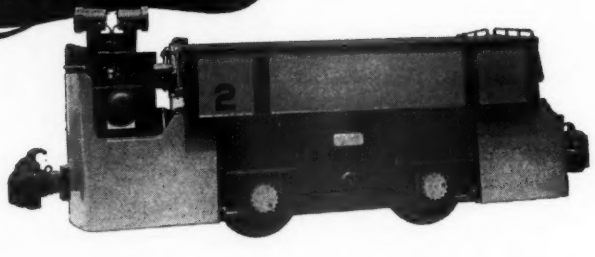
American Smelting Enlarges Plant

New laboratories for research in asbestos, high purity metals and refractory metals will be constructed in the near future by American Smelting and Refining Co., it was announced recently. The laboratories will be constructed at the South Plainfield (N. J.) plant.

Dr. A. J. Phillips, vice-president in charge of research, said that the construction will begin immediately and full operation is expected by the end of the year. It will provide more than 20,000 sq ft of laboratory space.

GREENSBURG EIGHT TON MONITOR
Storage Battery Locomotives

...for top performance "Double Equalizers" make the difference



The Greensburg 8 ton Monitor is equipped with two glass insulated motors, contactor type controller and double equalizers. These double equalizers make the difference in performance . . . more tractive effort, better brakes, better riding qualities and longer battery life than any other storage battery locomotive of equal weight and battery capacity!

All Greensburg locomotives are Custom-Built to meet your requirements in both single and double motor drive with drum, cam or contactor type controllers.

For more earning power per invested dollar specify Greensburg Storage Battery Locomotives.

GREENSBURG MACHINE CO.

112 Stanton St.
GREENSBURG, PA.

Lead, Zinc Meetings

The Lead Industries Association and the American Zinc Institute, Inc., will hold their annual meetings at Chicago's Drake Hotel on April 24-25 and April 25-26, respectively. The joint session on Thursday will include reports on the current world supply and consumption of both metals as well as current lead and zinc markets. Other sessions will be devoted to the two individual metal fields.

"Sutton"

SAND DRYING STOVES

The standard for over 50 years

Indiana Foundry Co.

156 Clymer Ave.
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Incentive Plan

A new suggestion plan carrying a top award of $10,000 for non-management employes was initiated March 1 by United States Steel Corp.

At the start, the suggestion plan will cover most U. S. Steel plants and offices in Pennsylvania, Ohio, Indiana, and Illinois, and all of its coal mines in Pennsylvania, West Virginia, and Kentucky. Arrangements are being made to extend coverage to divisions and subsidiaries of the corporation before the end of the year.

The program is designed to stimulate constructive thinking by all employes, reward them for worthwhile suggestions, and give recognition for individual ingenuity and creativeness. As defined, a "suggestion" is a proposal of a definite idea which will lead to the establishment of new or improved practices, products or facilities.

General areas in which suggestions will fall include reductions of cost, waste, maintenance, hazards to health, or possibilities of accidents or fire; increases of product utility, quality, yield or production; conservation of materials, energy, power or time; and development of merchandising or sales ideas, new sources of revenue, or new products.

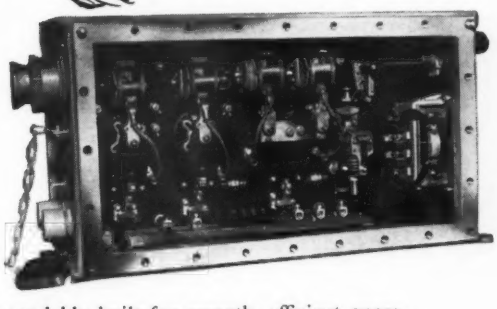
Awards for adopted suggestions will range from a minimum of $10 on up to $10,000. In exceptional cases, consideration will be given to even higher awards. All awards will be based on management judgment of the value of the adopted suggestion.

FIRST CHOICE OF MINE OPERATORS...

ENSIGN

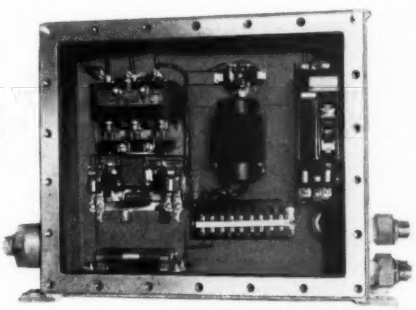
ELECTRIC STARTERS

Standard of the industry for safe and efficient starting of all types of heavy electrically operated mine machinery.



ENSIGN Bulletin 5392
Reduced Voltage Starter

Sturdily designed and dependably built for smooth, efficient operation of belt conveyor systems and other heavy mine equipment. Three point acceleration—reversing, with reversing switch interlocked to prevent plugging—Bureau of Mines explosion-tested enclosure. 20-30 HP, 230 Volt D.C. capacity.



ENSIGN Bulletin 6320
40 H.P. A.C. Magnetic Starter

Bureau of Mines explosion tested enclosure—non-reversing with air circuit breaker and selector switch. Available in manual and magnetic reversing.

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AMC SHOW, CLEVELAND, MAY 13-16

Product of ENSIGNeers

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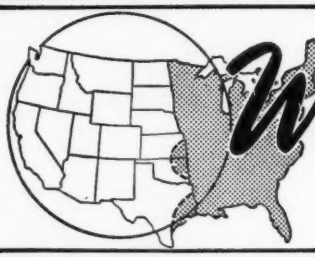
ELECTRIC AND MANUFACTURING CO.

914 Adams Avenue — Huntington 4, W.Va.



Western States

American Zinc Buys Mine

Karl W. Jasper, president, Grandview Mines, Spokane, Wash., and Howard I. Young, president, American Zinc, Lead & Smelting Co., St. Louis, Mo., have announced that American Zinc has purchased from Grandview all of its property, plant and equipment at the Grandview Mine property at Metaline Falls, Wash.

American Zinc has also entered into a lease and purchase agreement with Grandview for the Grandview Mine. Terms of the transaction were not disclosed.

American Zinc has operated the Grandview property since 1936. A royalty leasing arrangement was in effect from 1936 to 1950, and since then the operation has been on a profit-sharing basis. The lease-purchase agreement will continue to provide Grandview with royalties for several years, Mr. Young said.

Wyoming's First Uranium Mill

Lost Creek Oil & Uranium Company's $4,750,000 plant on the Sweetwater River near Crooks Gap, Wyo., will begin processing about June 1, according to Robert W. Adams, president. Wyoming's first uranium mill, the plant is expected to help the State's uranium mine production. Adams also disclosed that Lost Creek now has in excess of 400,000 tons of uranium ore in its own known ore reserves and those of mining companies the mill also will serve.

To Operate 11 Dredges

The U. S. Smelting Refining & Mining Co. will operate 11 dredges this year in Alaska. Eight will be located in the interior with the Fairbanks Exploration Co., a subsidiary of the parent company.

Yuba Manufacturing Co. of San Francisco, Calif., completed erection of a new dredge at Nome last summer, utilizing machinery salvaged from a dredge which capsized three years ago.

The new USSR&M mining venture in the Hodgatza River region northwest of Fairbanks did not get to the dredging stage last summer, although the dredge is ready to start work this spring.

Work on Salt Lake Convention Program Under Way

The American Mining Congress 1957 Metal Mining and Industrial Minerals Convention, to be held in Salt Lake City September 9-12, is approaching the concentrated planning stage.

Under the general chairmanship of L. F. Pett of Kennecott's Utah Copper Division, this year's meeting—the most important annual meeting in the west—promises to be an outstanding event. Assisting Pett as vice chairman are Oscar A. Glaeser of U. S. Smelting Refining and Mining Co. and Clark L. Wilson of New Park Mining Co., with Miles P. Romney of the Utah Mining Association serving as secretary to round out this impressive team.

L. F. Pett

O. A. Glaeser

The whole-hearted cooperation and effort of a host of others in the industry assures smooth coordination of convention activities. The welcoming functions are in the capable hands of Frank A. Wardlaw, Jr. of International Smelting and Refining Co., chairman and Kuno Doerr, Jr. of American Smelting and Refining Co., vice chairman. W. G. Adamson of the Adamson and Buchman Agency in Salt Lake City is chairman of Publicity, and J. Stanley Mitchell, Calera Mining Co., and F. V. Richard of American Smelting and Refining Co., are chairman and vice chairman of the Trips Committee.

The Ladies Committee is headed by Mrs. Oscar N. Friendly as honorary chairman, Mrs. Whitman G. Rouillard as chairman, Mrs. Miles P. Romney as vice chairman and Mrs. Clark L. Wilson as secretary. They have already made real progress in setting up a series of delightful events that no miner's wife will want to miss.

The Program Committee, with A. H. Shoemaker of Homestake serving as national chairman, is shaping up well. Leaders from industry have accepted state and area chairmanships covering all of the United States, and suggestions for program topics are pouring in. From these a balanced, up-to-the-minute program featuring the latest word on Government and industry policies and problems, as well as the newest developments in operating and technical phases of mineral production and treatment, is taking form. Suggestions from MINING CONGRESS JOURNAL readers for program subjects and speakers are welcomed and will be placed before the committee at its June meeting.

The economic and legislative problems confronting the industry will be under careful scrutiny by the Resolutions Committee, which will put together another hard-hitting Declaration of Policy to guide the activities of the American Mining Congress for the coming year.

C. L. Wilson

M. P. Romney

Interest is running high in this meeting at Salt Lake City, the geographic center of western mining. So don't put off getting your hotel reservations. Request them on the A.M.C. hotel reservation form or by letter to the A.M.C. Housing Bureau, Convention and Visitors Bureau, P. O. Box 329, Salt Lake City, Utah.

Gets Nevada Silver Property

Coast Mining & Development Co., a Nevada Corp. with mining headquarters at Yerington, has acquired the Bonanza Silver claim, in the East Walker River district, in southern Lyon County, Nev. Development work has been under way for several months under the direction of C. L. Stuart, director and superintendent of the corporation's mining operations.

To Sample Manganese

The sampling section of the Wenden Manganese Depot at Wenden, Ariz., is being reopened, according to an announcement by Robert E. Reno, of the General Services Administration. Purpose of the reopening, Reno said, is to permit the sampling of carload shipments of high-grade manganese originating in the area prior to their transfer to the national stockpile.

Kennecott Improvements

Kennecott Copper Corp. will spend an additional $18,000,000 to improve facilities and operations at its Utah Copper Division operations.

The bulk of the expenditure—$16,000,000—will be for expansion of the company's central power station at Magna. It will include the installation of a 75,000-kw turbine-generator, new boiler, cooling towers, electrical switch equipment and a 20-ft extension to the present building.

L. F. Pett, general manager of the Division, estimated the actual work on the facilities at the power plant will commence late this fall. The entire project is expected to be completed within 2½ to three years.

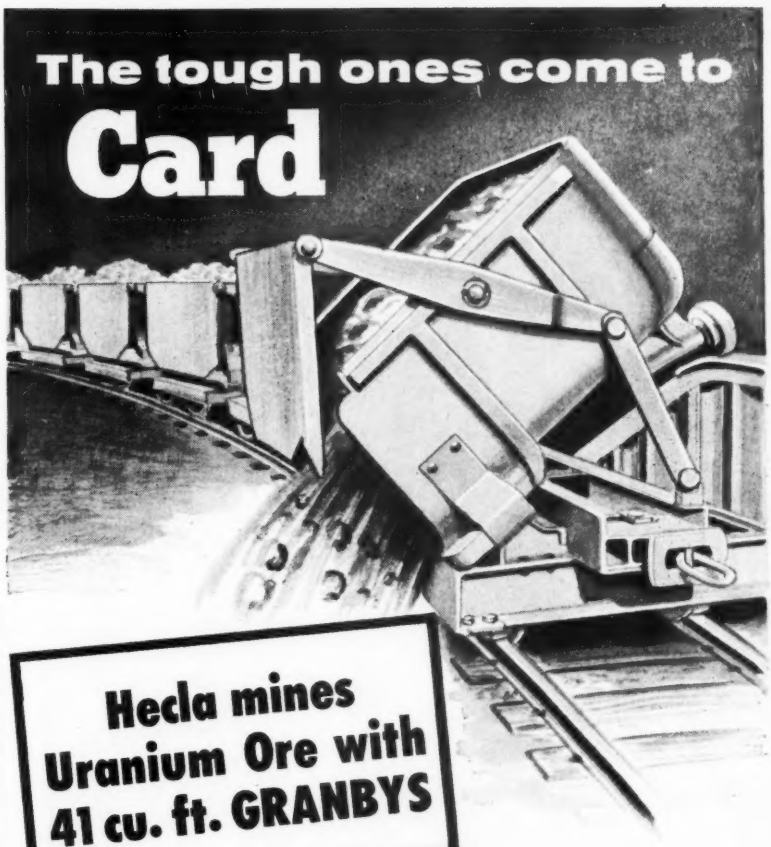
The new 75,000-kw generator will boost the central power plant's output to 175,000 kw. Present facilities include two 25,000-kw and one 50,000-kw generators.

Other major expenditures approved in the immediate future include; $742,500 to raise the tailings pond dike at the mills; $245,000 for new cradles for the Magna mill car dumper; $84,809 in supplemental funds in connection with laying new trackage and electrification of the Carr Fork A Level and D dump line connection at the mine.

Other funds will be expended for office equipment at all properties, automotive equipment, conversion of mine wrecking crane, self propelled multiple tie tamper, ventilating facilities at the mine boiler shop and other equipment.

The $18,000,000 approved for expenditure is in addition to $12,000,000 to be spent within the next two years for a new ore haulage tunnel from the bottom of the Bingham Canyon pit to the Copperton assembly yards at the mouth of the Canyon.

The tough ones come to Card

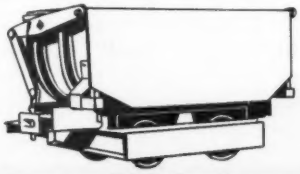


Hecla mines Uranium Ore with 41 cu. ft. GRANBYS

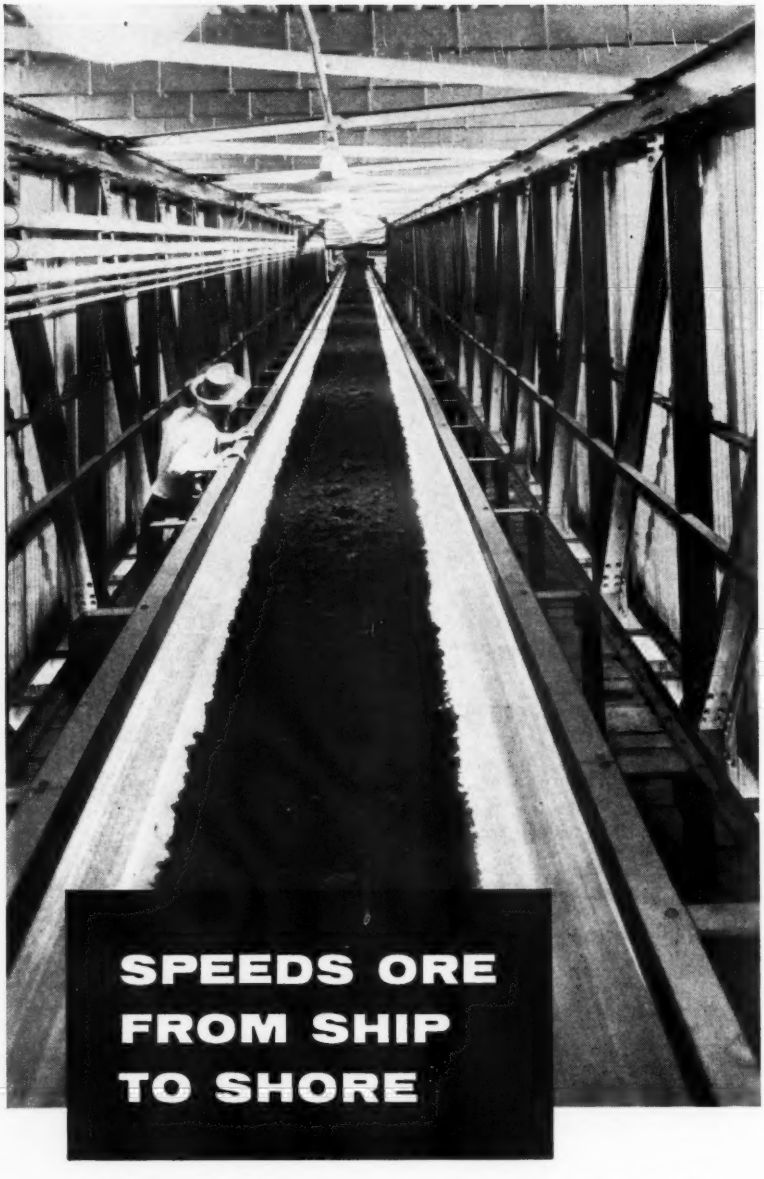
Hecla Mining Company opened their Radon property with 20 small Granby-type Card cars designed specifically for this underground service. Hecla is operating one of the deepest uranium mines in the U.S.A. with a well planned mine plant.

The underground haulage involves up to 300 tons per day of 0.7 percent U_3O_8 ore. Each Card Granby car has a capacity of 41 cu. ft. and is built on 24" gauge. When the Radon orebody is exhausted, the cars will still be able to "outlive" another Hecla mine of comparable size without major repair or replacement.

Such haulage efficiency and long life are yours whenever your choice is Card. Our engineers are at your service on any production haulage problem.



C.S. Card Iron Works Co.
2501 WEST 16TH AVE.
DENVER, COLORADO



This Hewitt-Robins slope conveyor takes ore from a 48" H-R dock conveyor which runs the length of the Canton Railroad ore pier in Baltimore. It carries 3,000 tons of ore per hour up a 16° slope into a weighing station for loading into railroad cars.

This continuous flow of materials cuts handling costs, speeds turn-around time for ships and shore carriers. Here, as in hundreds of industrial applications, Hewitt-Robins engineered, manufactured, and installed the complete bulk materials handling system. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Connecticut.

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HR HEWITT-ROBINS

CONVEYOR BELTING AND IDLERS . . . POWER TRANSMISSION DRIVES
INDUSTRIAL HOSE . . . VIBRATING CONVEYORS, SCREENS & SHAKEOUTS

Safety Record Improved

Kennecott Copper Corporation's Chino Mines Division has announced that its employes have turned in a safety record that shows an over-all improvement of 22 percent for the year 1956.

The record shows an average of 7.6 injuries for each million man-hours worked and only 115 shifts lost due to injuries in 1956. Kennecott's Chino Mines Division operates three shifts per day, seven days a week, and employs about 2500 men. During 1956, Kennecott employes turned in a total of more than four and one-half million man-hours of work and there were only 37 accidents which resulted in injuries that caused lost time from the job.

Montana Uranium Mine Sold

Final papers in the agreement for purchase of the Lucky Joe uranium prospect on the west fork of the Bitterroot River in Ravalli County, Mont., were signed in January by Hypotheek Mining & Milling Co. and National Uranium Corp. The property was purchased from two Wallace, Idaho, businessmen.

The purchase agreement provides that the companies will reimburse the vendors for the amount which they spent on discovery and development work and for the down payment on the ranch property on which the ore discovery was made. It also provides that the new owners will spend a minimum of $10,000 during 1957 on exploration and development of the property.

BOOK REVIEW

THE CONTROL OF RADON AND DAUGHTERS IN URANIUM MINES AND CALCULATIONS ON BIOLOGIC EFFECTS. *U. S. Department of Health, Education, and Welfare, Public Health Service, Washington 25, D. C.*

A long range study under way by the Public Health Service since 1950 seeks to define the effects of uranium mining operations on the health of the miners and to derive data leading to the establishment of a healthful working environment.

Publication No. 494 describes the results of the environmental study to date, together with the work of other investigators, with reference to methods of measuring atmospheric concentrations of radon and daughter products, the establishment of a safe working level of radon daughter products, and the development of effective control measures.

The material presented will be found useful by the industry and others, particularly in evaluating health hazards and in deriving control methods.

To Acquire Newmar Holdings

William R. McCormick, president of Standard Uranium Corp., announced that the company is completing negotiations to acquire all the properties and assets of Newmar Mining Co. Newmar holds extensive patented mining claims in the lead, copper, gold, and silver producing areas of the San Juan and Crested Butte regions of western Colorado.

No plans have been formulated for the handling of the large holdings of uranium properties held by Newmar which are located in the White Canyon area of Utah, northwestern Colorado, and in the Gas Hills of Wyoming.

Uranium Ore Upgrading Plant

Mountain Mesa Uranium Corp., Casper, Wyo., is planning to build a $1,000,000 uranium plant at Cal-Uranium properties in the Big Indian District, San Juan County, Utah.

The contemplated 1000-tpd plant would treat low-grade ores from the Cal ore body as well as from other producing mines in the area.

Mining Booklet Issued

The Montana Bureau of Mines and Geology has issued a booklet entitled "Operating Ideas for Small Mines." It is the result of on-the-spot investigations of small mine operations by the author, Koehler S. Stout, chief of the Bureau's mining division.

The 14-section booklet, which contains 36 pages of diagrams, plates and photographs, may prove helpful to prospectors and small mine operators.

Copper Mine to Close

Howe Sound Co. is planning to close its Holden Mine in Chelan county, Wash., the largest copper producer in the state. The tightening squeeze between rising mining costs and lower copper prices is responsible for the shutdown, according to the company's annual report. The shutdown will be gradual, and little reduction in the crew, which has averaged between 200 and 225 men during the past year, is anticipated until present mine stopes are worked out. This is expected to take four or five months, following which salvage operations will be started and probably will not be completed for another 18 months.

Also slated for closing is the Howe Sound gold mine at Snow Lake in Manitoba, Canada. Usable ore reserves at this property are close to exhaustion.

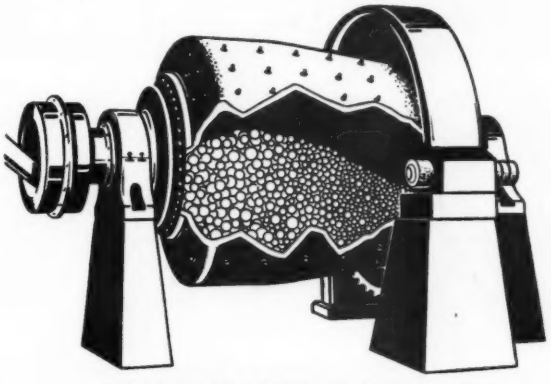
The Holden property was discovered about 60 years ago, but active mining operations were not started until after Howe Sound took over in 1929. The company's investment in developing the mine during the next three decades totaled more than $3,000,000, including installation of a 1000-ton concentrator plant in 1938.

Great Western Grants Lease

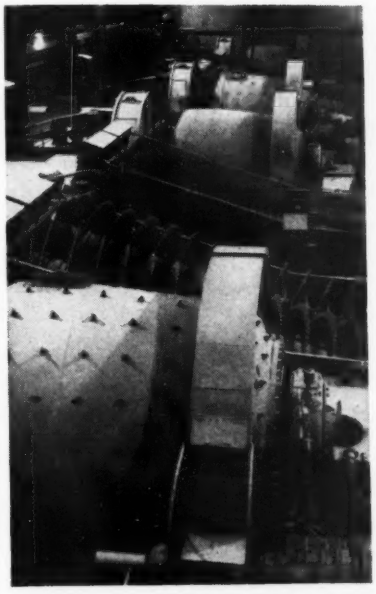
Great Western Mines Co., Provo, Utah, has entered into a lease agreement with the New Park Mining Co., Salt Lake City, Utah, and Harold W. Meyers involving the Great Western claims in the Snake Creek Mining District. The lessees will commence development work on the leased claims by May 1, 1957. The lease is for a ten-year period and requires the lessees to perform substantial work commitments over the period of the lease.

Superintendent Wanted

Metallurgist-Assistant Mill Superintendent wanted for 400-700-ton lead-zinc-copper flotation plant located in Colorado. Please reply stating experience and qualifications to Box 457, Mining Congress Journal.



TRICONE MILLS



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Complete specifications upon request. Bulletin AH-414-52.

Four 11′ diameter Hardinge Tricone Mills at a Canadian Concentrating Plant.

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Sulphur Shipments Started

Regular shipments of liquid sulphur from the new British-American separation plant at Pincher Creek, Alberta, Can., will be made to the Northwest Nitro-Chemical Co. at Medicine Hat, Alberta. The Pincher Creek plant, which will be expanded as the field's petrochemical industry grows, is now in experimental production but sulphur and condensate are moving. Sulphur from the Pincher plant also will be shipped to a pulp mill in Alaska once it moves into full operation.

Ore Station Closed

The Atomic Energy Commission's uranium ore buying station and sampling plant at Marysvale, Utah, was closed March 15. Most of the mines in the Marysvale area now are selling directly to Vitro Uranium Co. or the AEC at Salt Lake City.

Minerals Conference

The Fourth Annual Rocky Mountain Minerals Conference will be held in Denver, Colo., on October 30, 31 and November 1. This is a regional meeting of the American Institute of Mining, Metallurgical and Petroleum engineers, sponsored this year by the Colorado Section. The technical program will consist of papers on various phases of mining, ore treatment and geology.

Galena Mine Deepened

American Smelting & Refining Company's Galena mine west of Wallace, Idaho, is being deepened 600 ft to the 4000-ft point—which will be about 1000 ft below sea level. A winze of standard shaft size will be put down about in the center of the mine's main silver-copper vein from the present 3400 level. Several new working levels will be opened from the winze and connections driven to the main shaft, which is about 1100 ft westerly from the winze site.

Name Shaft After W. A. Burgin

Bear Creek Mining Co., wholly-owned domestic exploration affiliate of Kennecott Copper Corp., has named the new 1080-ft exploration shaft on its Eureka district of Utah lead-silver-zinc project after the late William A. Burgin. Burgin, who perished in a commercial airline crash in the Rockies a year and a half ago, was former regional exploration chief for Bear Creek at Denver.

The new Burgin shaft is being sunk for Bear Creek by Centennial Development Co. The two-compartment shaft will be completed in July or August.

11 Western Governors Meet

Eleven western governors will meet in Reno, Nev., April 26 and 27 to attend a meeting of the Western Governors' Conference, called by Governor Charles Russell, chairman of the group. Top items on the agenda are the problems of expanded highway building under the new Federal program, and the development of a long-range mineral policy.

In connection with the latter item, the Western Governors' Mining Advisory Council will meet in Reno April 24-25 to formulate recommendations to present to the governors.

S. H. Williston, vice-president and general manager of the Cordero Mining Co., which operates in Humboldt County, is chairman of the mining council, and Louis D. Gordon, secretary of the Nevad Mining Association, is council secretary and chairman of the Nevada advisory group.

Begins Mexican Sulphur Output

Texas Gulf Sulphur Company's Mexican affiliate, Compania Exploradora del Istmo, S. A., has begun production of sulphur with its recently completed Frasch system extraction plant at Nopalapa, Veracruz, on the Isthmus of Tehuantepec in southern Mexico.

Production began after almost seven years of exploration and development and an investment of more than $10,000,000.

Texas Gulf's affiliate obtained the concession from the Mexican Government late in 1949, receiving lands sufficient to carry out a large-scale exploration program.

Magma Production Rises

The San Manuel, Ariz., mine of Magma Copper Co. is expected to reach full production at an annual rate of 70,000 tons by July, according to the company's annual report.

Magma's production of copper in 1956 was 63,043 tons, of which 39,076 tons came from San Manuel. The 1955 total was 24,000 tons. The San Manuel mine was producing at a rate of about 65 percent of its scheduled annual capacity at the year's end.

It had been expected that the full rate at San Manuel would be attained by the end of 1956, but underground mining problems were encountered as well as the failure of some electrical equipment at one of the two main ore hoists. These problems have been corrected.

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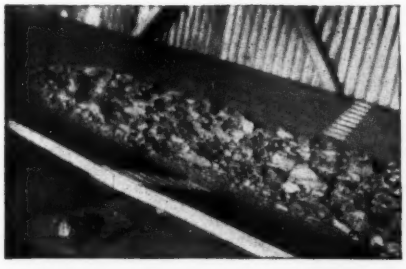

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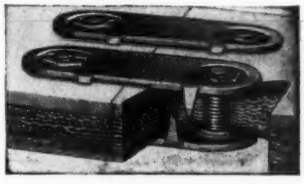

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Asarco Gets Copper Prospect

American Smelting & Refining Co. has concluded an agreement with Northlodge Copper Mines to explore the latter's 40-claim copper prospect in the Highland Valley of British Columbia adjoining the Bethlehem Copper Corp., Ltd., holdings already under exploration by Asarco, according to D. F. Farris, Northlodge president.

Terms of the agreement require Asarco to make a preliminary examination within six months of a substantial anomaly on the property. An additional period of 2½ years for exploration and development will then be granted and should this phase of the program prove successful, Asarco will have another two years to bring the property into production.

New Metals—Bonanza Merge

The Department of Investments of the Commissioner of Corporations for California has issued a permit authorizing New Metals Corp. to merge into it Bonanza Uranium Corp. on the basis of one share of New Metals for two shares of Bonanza. The merger brings into New Metals Corp. several properties in addition to working capital. One group of 500 claims is in New Mexico; other properties are located in Colorado, Utah and Arizona.

INCO Contracts Mine Plant

International Nickel Co. of Canada, Ltd., has signed a $65,000,000 contract, largest in Manitoba's history, with the Foundation Co. of Canada for construction work at Moak Lake, 400 miles north of Winnipeg.

The main work to be done under the contract will be construction of two mine surface plants, a mill smelter and service buildings. The contract is the third to be awarded in connection with the $175,000,000 nickel mining project.

Mica Mine Optional

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has an option to purchase the Old Mike Mica mine near Custer, S. Dak., the South Dakota Industrial Development Agency has announced. The option covers 25 mining claims, the crushing and screening plant and auxiliary building and equipment.

Present owner of the mine, which has been operated intermittently since 1880, is Mineral Mills, Inc., of Custer. The mine has not been in operation since shortly after World War II.

If the purchase is consummated, the Old Mike Mine will provide 3M with its first domestic source of mica used by Samica Corp., Rutland, Vt., in manufacturing insulating papers. Samica is a 3M subsidiary.

Manufacturers Forum

2000 Psi Vane Pumps

A SERIES OF BALANCED VANE hydraulic pumps for continuous 2000 psi service has been announced by the Denison Engineering Division, American Brake Shoe Co.

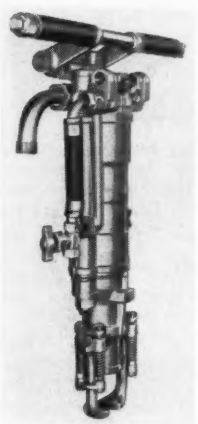
Known as the T Series, these pumps supply rated deliveries of up to 100 gpm at speeds up to 1800 rpm. The pump is available with either clockwise or counter clockwise shaft rotation, and may be face, foot or flange mounted in any of four positions on its mounting bracket.

The pump consists of a housing which provides an outlet connection, a bore for support of the shaft bearing and shaft assembly and a larger bore which contains the floating pumping cartridge consisting of a front port plate, vane, rotor and carn ring assembly and rear port plate with a shaft end support bearing.

It is said that this pump opens the way for the use of higher pressures in hydraulic systems.

Shock-Absorbing Handle

VIBRATION IS ABSORBED by rubber cushions incorporated into the mechanism of this handle, which was designed for use with Le Roi-Cleveland H-10, H-12, and H-111 sinker drills. Handle adjustment can be made to suit operator's desired degree of sired degree of vibration dampening.



The shock-absorbing handle is standard equipment on the three drills listed above. Modification kits are available for equipping former models of these drills with the handle.

Additional information is available from the Sales Promotion Dept., Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wis.

Inquiries about new equipment appearing in Manufacturers Forum are welcomed. For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

Compressors

AIR-COOLED compressors in a medium-capacity range, the CT series recently developed by their Swedish affiliate, have been added by the U. S. Atlas Copco Companies in a continuing expansion of their compressor sales-and-service divisions.

Officials point out that a completely air-cooled compressor plant can be achieved by powering the CT units with a Dentz air-cooled diesel engine.

New models include the 45-hp CT-4 developing 175 cfm, and the 75-hp CT-6 delivering 340 cfm. Skid-mounted, with weights of 1300 and 1900 lb, respectively, the models are two-stage, single-acting types which develop their rated capacities at 970 rpm.

Illustrated literature is available from: Compressor Division, Atlas Copco Pacific Inc., 930 Brittan Ave., San Carlos, Calif., or Atlas Copco Eastern Inc., Paterson, N. J.

Cleats for Conveyor Belts

AVAILABLE IN FOUR HEIGHTS —7/16, ¾, 1, and 1½ in., all in 36 in. lengths—REMA Cleats reportedly are being used to advantage on conveyor belts where the belts are inclined to the point where gravel, large wood chips or other items would have a tendency to slip or roll back down the belt.

They can be applied to the belt at 90° (across the belt) in the form of chevrons or "V's," along the sides of the belt to act as guide rails or in any pattern desired.

REMA Cleats are distributed nationally by Flexible Steel Lacing Co., 4607 Lexington St., Chicago 44, Ill.

Shaft Sinker

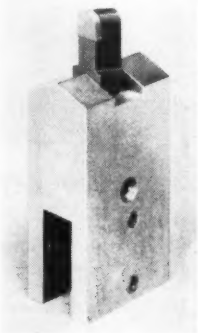
WITH AIR MOTOR FEEDS and air motor controlled booms, the SDR shaft sinker is available with two, three, four, or six booms and a choice of six different drills. Available feeds include the DR40 with the standard ten-ft air motor feed and the DR34 with the standard 6 ft 8 in. piston feed. Drills which can be ordered are the H10DR, H12DR, and H111DR—all 2⅝-in. drills; the 3⅛-in. H28DR; the 3½-in. D25DR; and the 4-in. D14DR.

Maximum drilling area diameter is 26 ft, when arms are extended. The sinker closes to 11 ft 6 in., but drills can be toed-in to drill next to the pedestal, which is four ft in diameter. Height of the SDR is 18 ft 6 in.

Marketed by the Le Roi Division, Westinghouse Air Brake Co., Milwaukee, Wis., the SDR has a centralized oiling system and needs only one master air line from top-side down the shaft to the top of the shaft sinker.

Bits and Block Holders

CARBIDE-TIPPED bits and block holders, which are reputed to increase the efficiency of barrel-type coal recovery auger heads while reducing bit costs and changing time, have been announced by Austin Powder Co., Cleveland 13, Ohio.



Provided with tapered shanks, the bits drive-fit into the conical holding devices of the blocks. When cutting pressure is exerted, bits become seated. Block holders have four Allen Head screws to permit positioning on drill head prior to welding.

Blocks and bits are adaptable to either new or previously-used barrel-type drill heads. Bits, which are ⅞ in. wide and 3½ in. long, have a protective black oxide finish that reportedly will not corrode even if stored indefinitely.

Sump Pumps

TWO SELF-PRIMING air-powered sump pumps with capacities ranging from 222 gpm at a 30-ft head to 20 gpm at a 200-ft head have been introduced by Atlas Copco AB. The pumps weigh approximately 50 lb and operate on pressures of 85 psi. They can be used for pumping clear or dirty water, oil, sewage and moderately heavy sludge. Designated the LPC-21 and LPC-41, the pumps consist of one-piece housings containing vane type motors and impeller type centrifugal pumps. Company spokesmen report they will operate when wholly submerged and will start under full loads.

The pumps are available either from Atlas Copco Eastern, Inc., 151 Linwood Ave., Paterson, N. J., or Atlas Copco Pacific, Inc., San Carlos, Calif., as well as through the firms' district offices throughout the United States.

Lift Truck

AN IMPROVED DUST PROTECTED, gasoline powered industrial lift truck has been introduced by The Yale & Towne Manufacturing Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa.

There are five main features on the truck which reportedly materially reduce the harmful effects of abrasive dusts and lint to mechanical and electrical parts. These include a tandem air cleaning system which filters air going into the carburetor, oil filter, air filter on the crankcase breather pipe, and a deflector plate which protects the bottom of the truck and reduces the possibility of foreign particles on the floor from being drawn up into the engine compartment. The generator and voltage regulator are completely enclosed for the preservation of commutator surfaces and extended brush and contact life.

V-Belt

WITH AN OIL RESISTANT COVER to prolong belt life, the Powerflex Hi-Capacity V-belt is said to have up to 40 percent more strength than standard belts; thus lower drive costs can be achieved since fewer belts and narrower sheaves are required to handle a load. The belt is available in all standard sizes and can be furnished with static conducting covers. A and B section belts are manufactured with nylon laminated construction and C, D, and E sections are of heavy rayon grommet construction. For additional data write to Thermoid Co., 200 Whitehead Rd., Trenton, N. J.

Crane-Excavator

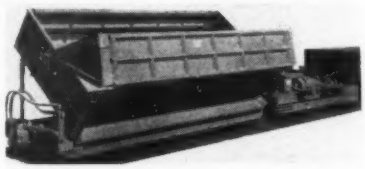
IN THE ONE-YD CLASS, this crane-excavator, model 30-B, is a readily convertible shovel, dragline, clamshell, crane, or drag-shovel. It is offered with five sizes of crawler mountings, or as a carrier-mounted Transit Crane rated at 35 tons.

Main operating functions of the machine are air controlled. The 30-B crawler is available with diesel engine with either direct drive or torque converter drive, gasoline engine with direct drive, or electric motor. The Transit Crane is offered with gasoline engine with direct drive as standard equipment. A diesel engine is available as optional equipment.

More information can be obtained by writing direct to Bucyrus-Erie Co., South Milwaukee, Wis.

Self-Dumping Car

A HYDRAULIC Self-Dumping Granby Type Car has been developed by Sanford-Day Iron Works, Inc., Knoxville, Tenn. Each car has a pair of telescopic hydraulic cylinders that



raise the body to a dumping angle of 40°. Dumping is controlled by a four-way valve on each car, which is manually actuated by a lever at the side of the underframe by the trip rider. Hydraulic power is supplied by a power unit mounted on a small car that is coupled in the trip. Hydraulic hoses connect the cars by means of self-sealing couplings.

Fume-Exhausters

REMOVAL OF NOXIOUS FUMES from the work area is vital to all industry. The W-200-50 Stand Type Exhausters, movable on steel casters, are designed to go close to the fume site, apply a high suction and then push the fumes to the nearest opening to the external atmosphere. The Engwald exhausters comprise gasoline or electrically driven blowers capable of moving up to 800 cfm, plus eight-ft stainless steel hose assembly including arms and counterbalance for universal positioning. Available hose diameters are 4, 6 and 8 in.

For more information write to Engwald Corp., 357 Lafayette Ave., Brooklyn 38, N. Y.

Portable Electric Generator

TWO 1500-WATT portable electric generators, featuring a vertical shaft design, have been introduced by the Thor Power Tool Co. With the vertical shaft, according to company officials, the entire weight load of the generator is supported by tubular framework. Since the engine main bearing and shaft only has to turn the armature—not support it as well—longer life and more efficient service is expected.

A further advantage cited by the company for the vertical design is simple shock mounting which isolates the rotating armature action and engine vibration from the frame. The entire assembly "floats" in the framework that serves also as protective guard and carrying handle.

Powered by gasoline engines, the two 95-lb Thor models—EG-1.5 A for alternating current and EG-1.5 D for direct current—provides 13 amp of 115-v current. Two plug-in outlets are provided.

Rotary Drill

SUITABLE FOR MOUNTING on any standard truck, a new rotary drill, designated Model M-8AL, utilizes both compressed air and high pressure water for drilling. Equipped with a special long drill bar and mast, it can drill 24-ft ledges without changing

steels. It has a rated capacity of 6¼-in. holes up to 600 ft with air and 1500 ft with mud.

For air blast drilling, a Davey 500-cfm unit compressor is used. The high pressure water pump is heavy duty duplex type. Compressor and pump are driven by a GMC-471 engine mounted on the truck bed. A five-speed transmission permits operation of the drill at its most efficient speed.

For full details write Rotary Drill Division, Davey Compressor Co., Kent, Ohio.

Lift Truck

THIS PNEUMATIC TIRE lift truck has the compactness to work inside a single-door boxcar plus the traction and capacity to handle 7000-lb loads over rough yard terrain, according to the Hyster Co., 2902 N.E. Clackamas St., Portland 8, Ore. Features claimed for the Hyster 70 include a turning radius of 100 in., length of 106⅜ in., 70-hp Hercules gasoline engine, hydraulic booster-type power steering, self-energizing aircraft type brakes, and a one-piece frame and body.

Torque Converter

DESIGNED FOR HIGH-SPEED diesel and gasoline engines, the 1300 series Single-Stage Torque Converters are for engines producing from 30 hp at 1450 rpm to 212 hp at 3200 rpm. Specific torque ratings are 165, 200, 240, 285 and 330 lb ft, depending on the impeller blading selected by the user. Maximum input torque is 350 lb ft.

The 1300 Series unit is said to feature "unloading" of the engine through an exclusive blade design wherein the turbine develops a counter-head which stops fluid circulation at high speed ratios. This eliminates free-wheeled stators.

Production of the Twin Disc 1300 Series currently consists of one model —the Model F. This is a spacer-type arrangement with an SAE No. 2 engine flywheel housing size and an SAE No. 2 or 3 output housing.

Further data may be obtained from Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill.

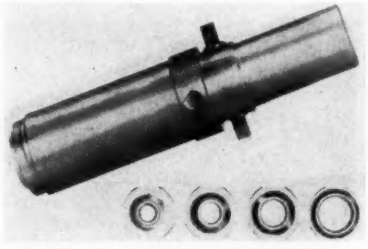
Safety Hats and Caps

FOR USE IN MINES and other places in industry where this type of equipment is required, the M-Series Supergard Safety Hats and Caps with Universal Lamp Bracket has been announced by the Boyer-Campbell Co., Safety Division, 6540 St. Antoine, Detroit 2, Mich. Supergard Hats and Caps provide for both electric and carbide lamps, and are equipped with polyethelene head suspension that can be adjusted to all head sizes—6⅝ to 8.

Nipple Chuck

ON-THE-JOB threading of pipe or conduit nipples of any length is said to be possible with either hand threaders or power drives through the use of the Speed-Thru Nipple Chuck.

The manufacturers claim that the patented chuck is the only tool on



which nipples of any length can be made with all threaders that are adjustable to two in. Due to the movable sleeve guide, there are no "dead spots" to prevent threading to any pre-determined length, fractional or otherwise.

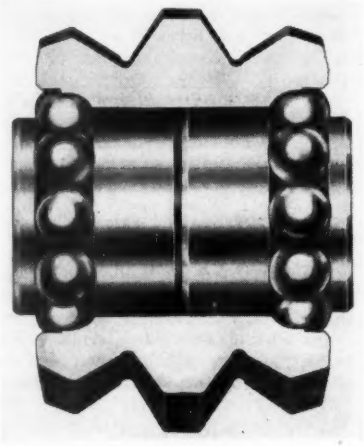
Descriptive literature is available from Mercury Hydraulics, Inc., 2440 Blake St., Denver 5, Colo.

Transmission

THIS SEVEN-SPEED Fuller Roadranger Transmission, the R-35 model, is designed for gasoline engines up to 400 cu in. of piston displacement. The R-35 is a unit mounted transmission without an auxiliary section and weighs 375 lb. Length is $26\frac{25}{32}$ in. Detailed information may be obtained from Fuller Manufacturing Co., Transmission Division, Kalamazoo, Mich.

Ball Bearing

M-R-C ROLLER TOOTH Ball Bearings, manufactured by the Marlin-Rockwell Corp., Jamestown, N. Y., are designed for use in the manual steer-



ing mechanism of automobiles, trucks and tractors. The profile of the bearing outer ring permits it to engage a worm gear on the steering shaft. This type of bearing reportedly can be adapted to other applications.

Boom Pendant Thimble

BOTH IN THE OPEN AND CLOSED, this boom pendant thimble is being produced from high carbon electric steel castings. The manufacturer claims that it will increase fatigue resistance of the wire rope and dampen vibration. All sizes are interchangeable with standard open and closed sockets. Write for full details to Newco Manufacturing Co., Dept. 117, P. O. Box 5939, Kansas City 11, Mo.

Protects Belt Splices

A SELF-VULCANIZING rubber repair material, REMA is used to cover or protect conveyor belt splices made with Flexco Fasteners.

Two methods are generally used. In one the Flexco Fasteners are recessed in the belt and then covered with REMA surface strips. In the second method both ends of the belt are sealed with REMA Red Filler Sheeting before applying Flexco Fasteners, minimizing deterioration of belt ends.

REMA reportedly seals out moisture and reduces mildew, rot and deterioration. Belts can be put into operation as soon as joint is made and REMA is applied, according to the company, and no heat or heavy vulcanizing equipment is required.

Both methods are described in REMA Illustrated Directions No. 4. Write to Flexible Steel Lacing Co., 4607 Lexington St., Chicago 44, Ill.

— *Announcements* —

Mine Safety Appliances Co. has established a wholly-owned subsidiary in Venezuela. The new firm, **Mine Safety Appliances de Venezuela C. A.,** will handle all sales and service in Venezuela, with Walco S. A., also a Venezuelan corporation, as sales agent.

C. M. Donahue

C. M. Donahue, vice-president of the parent corporation and head of the International Division, will be president of the Venezuelan Firm. **J. T. Ryan, Jr.**, president of MSA, will be a vice-president of the subsidiary. Another vice-president will be **G. H. Deike, Jr.**, with **C. P. Rooney** as secretary.

J. T. Ryan, Jr.

G. H. Deike, Jr.

Ohio Brass Co. announces the appointment of **R. G. Manis** as district manager in southern West Virginia, to work in cooperation with Charleston Electrical Supply Co., long-time O-B agent in that area. **Wm. C. Preston** will take over Manis' former duties as district manager in Eastern Kentucky.

M. L. McCormack has been appointed special representative for the mining division for **Ingersoll-Rand Co.** Replacing McCormack in his former post as manager of the New York rock drill sales department is **Joseph A. Wiendl.**

J. A. Wiendl

M. L. McCormack

McCormack was appointed to the newly formed post, according to H. G. Conkey, vice-president and general sales manager, to "maintain and improve our standing in the mining field."

John W. Crandall, district manager, North Central Territory, for the Mining, Crushing and Process Machinery Division of **Nordberg Manufacturing Co.**, has been appointed district manager of the territory with Duluth, Minn., as headquarters. His new territory includes Minnesota, North and South Dakota, and the northern sections of Michigan and Wisconsin.

Two veteran officials of the **Marion Power Shovel Co.** have resigned. They are **John P. Courtright**, Marion president from 1950 to March of 1955, and **Merle Virden**, secretary and treasurer.

Courtright has been associated with the company since 1927. In 1941 he was elected vice-president in charge of sales and in 1951 he was made executive vice president. In 1952 he was elected president. He was chairman of the Manufacturers Division of the American Mining Congress in 1953.

William T. Ahlborg has been appointed executive vice-president and general manager of **Denver Equipment.** Ahlborg named **F. J. Griesemer**, formerly in charge of Deco manufacturing facilities, as assistant general manager. **Douglas E. Newton**, general sales manager, will assume additional responsibilities in administration of the company's international manufacturing and sales organization.

W. T. Ahlborg

Douglas W. Vernon has been named product sales manager for wire rope and aircord by **John A. Roebling's Sons Corp.**

The Fairmont Machinery Co. of Fairmont, W. Va., has been granted the exclusive right to manufacture and sell the Chance Cone in the United States. This coal cleaning apparatus is used world wide for the separation of materials of different specific gravities and employs the process known as The Chance Sand Flotation Process.

Fairmont will maintain competent engineers to service new plants under construction as well as the many Chance plants now in operation.

The Jeffrey Manufacturing Co. recently announced the appointment of **Russell W. Knode** as general manager of sales, mining division and the retirement of **A. R. Anderson** who preceded Knode in that position. Knode who has been with Jeffrey for 21 years, had served as manager of field offices, mining division. Anderson, who had been with Jeffrey for 35 years, was general manager of sales for the past three years.

R. W. Knode

The company also announced the appointment of **Carl G. Schilbe** as district manager of the Salt Lake territory in charge of sales for both industrial and mining division products.

Mobile Drilling, Inc., Indianapolis, Ind., has purchased the Earth Drill business of the Buda Division of **Allis-Chalmers Manufacturing Co.**

No other products of the Buda Division or of Allis-Chalmers Manufacturing Co. are involved in the transaction.

CATALOGS & BULLETINS

WALL CHART OF CONVERSION FACTORS. *Precision Equipment Co., 3716 N. Milwaukee Ave., Chicago 41, Ill.* This conversion chart is useful for engineers, shop men and other executives. Included are common conversions such as inches to centimeters or watts to horsepower, as well as many other conversions that are difficult to locate in reference manuals.

BALL BEARING COMPONENTS FOR SCREW CONVEYORS. *Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.* Folder No. 2489 describes related ball bearing equipment being added to Link-Belt's screw conveyor component line. Technical data on selection and application of "Quik-Link" conveyor screws, trough ends and hangers are detailed, as are "get over or around" examples of how drive-end space problems can be solved. These ball bearing components are designed to fit new or existing screw conveyors.

TRACTOR TOOLS. *Hyster Co., 2902 N. E. Clackamas St., Portland 8, Ore.* How addition of the right tractor job attachment increases production and profit on virtually all types of construction and logging operations is covered in this informative catalog, "Hyster Tractor Tools." All Hystertractor job attachments, according to the company, offer the advantage of Caterpillar-built tractor mobility and maneuverability combined with the power of Caterpillar diesel engines. Shown in the catalog are the complete line of tractor-mounted accessories for Caterpillar-built tractors.

(Continued on page 154)

(Continued from page 153)

BUSHED ROLLER CHAIN. *Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.* Book No. 2454 contains a complete presentation of the many features of LXS bushed roller chain—plus application and selection data.

HOW TO INSULATE A CABLE. *The Okonite Co., Passaic, N. J.* This 28-pp booklet explains the four most-used methods employed by manufacturers for applying insulation to electrical conductors, describing the advantages and disadvantages of each. Wire and cable users will find the information helpful in choosing the right cable design for their needs.

MINING BITS. *Advertising Dept., Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh 22, Pa.* The revised booklet, "Carmet Mining Tool Catalog and Methods Manual," gives detailed descriptions as well as blue-prints of each mining bit the Carmet Division, Allegheny Ludlum Steel Corp., makes. Included are mining bits for straight shank cutter bits, milled shank cutter bits, forged shank cutter bits, special shank cutter bits, and roof bolting drill bits.

A REVIEW OF THE ZINC INDUSTRY IN THE UNITED STATES IN 1956. *The American Zinc Institute, Inc., 60 East 42nd St., New York 17, N. Y.* The Institute's annual review summarizes the production and consumption picture of the zinc industry as of December 31, 1956. Comprehensive tables cover such topics as mine production, imports of slab and ore, slab zinc consumption, zinc uses by grades, production of slab zinc according to grade, and tariff rates. The growth of zinc used for galvanizing and die casting is discussed. Present trends in plant expansion are noted, and producers' flexibility of operations commented upon.

HIGH TENSION SEPARATOR. *Carpco Manufacturing, Inc., Jacksonville 6, Fla.* Containing a comparison of electrostatic with high tension or electro dynamic separation, Bulletin No. HTB-103 lists typical minerals which can be separated, by high tension units, describes a laboratory model, as well as industrial separators, and includes a typical plant flowsheet for high tension separation.

INDUSTRIAL LOCOMOTIVES. *General Electric Co., Advertising and Sales Promotion Dept., Schenectady, N. Y.* Case histories of different types of General Electric industrial locomotives are contained in this 24-p. booklet. The publication, GEA-6332, is the second in a series of five that are designed to aid the prospective purchaser of industrial haulage, and it includes operating conditions and performances of 14 switcher-type and mining locomotives.

SPEED REDUCERS. *Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.* Entitled "Speed Reducer Engineering Manual," booklet B-6727 presents such information as hp ratings, torque capacity, overhung load valves, dimensions, construction features, installation and maintenance for single, double and triple reduction. Speed reducers may be driven by electric motors, gas, oil or diesel engines.

SPECIALIZED LUBRICANTS FOR CONTRACTOR EQUIPMENT. *Keystone Lubricating Co., 3100 North 21st St., Philadelphia 30, Pa.* Identified as Bulletin BU-58, it deals with special lubricants for contractor equipment used in (1) earth moving, (2) strip mining, (3) quarrying, (4) road building, (5) excavating, (6) logging, (7) dredging, (8) erecting and (9) allied fields. Two specification charts are presented: A chart of "semi-solid" lubricants gives working range, melting point, penetration, moisture repellence and body characteristics. A chart of "liquid" lubricants lists such data as flash and cold tests, SUV @ 100° F, SUV @ 210° F, and SAE numbers.

VARIABLE SPEED MOTOR PULLEYS. *Advertising & Sales Promotion Dept., Worthington Corp., Harrison, N. J.* Featured in Bulletin No. 1630-B1 P are motor pulleys (⅛ through ¾ hp) available with adjustable and tilting motor bases, companion sheaves, motor bases and V-belts. The bulletin is graphically illustrated by numerous charts that list complete ratings, dimensions and selection data for the various Worthington variable speed motor pulleys; the 24 QD Sheave stock sizes; and Worthington-Goodyear V-belts.

WIRE ROPE FITTINGS AND SHEAVES. *Sauerman Bros., Inc., 620 S. 28th Ave., Bellwood, Ill.* Two bulletins have been issued for users of wire rope fittings and sheaves. Bulletin No. 164 gives specifications of open and double wedge sockets for rope sizes from ⅜ to 2 in. and of continuous cable clamps for sizes from ⅜ to 1¼ in. Bulletin No. 165 shows specifications of Durolite Sheaves for sizes from 6 to 24 in.

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JOURNAL

when you put Bowdil Bits

in a Bowdil Chain

on a Bowdil Bar . . .

you find your greatest economy.

The BOWDIL Company
CANTON 7, OHIO

AT THE SHOW, BOOTH 1006

R-4 LAMPS—Brilliant, unfailing, effective light that means added safety for the miner, added production for the mine.

Spotlighting M·S·A Equipment

OF IMPORTANCE TO YOUR MINE SAFETY AND PRODUCTION

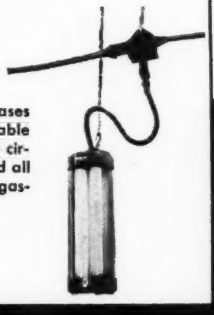
...at Booth 1009—Coal Show

M·S·A BANTAM ROCK DUST DISTRIBUTOR—MODEL 400

Dust discharge rate of 100#/min. through 25 ft. of 2" hose or 30#/min. through 400 ft. of 2" hose. Special nozzle equips unit for wet rock dust application in fire fighting.

M·S·A MINE LIGHTING SYSTEM

Cuts down accidents. Increases coal output. Provides dependable lighting with an instant start circuit that is safe under any and all conditions of ventilation in gaseous mines.



M·S·A EDISON R-4 TRIP LAMP

Provides illumination at all angles. Rectangular shape, small size, and strong forged steel hook allow hanging on side or back of any mine car. Minimum maintenance.

M·S·A MINE FIRE TRUCK

Designed for mobility and fast hook-up. Lets you fight fires fast. Rugged, low-slung, all steel. 5-inch treads for easy maneuvering. Painted bright yellow enamel.

M·S·A SELF-RESCUER

Emergency protection against carbon monoxide, smoke. Light, comfortable. Individual carrying case, or cache assembly for underground storage.

M·S·A CHEMOX® OXYGEN BREATHING APPARATUS

Complete breathing protection in any atmosphere for minimum of 45 minutes. Generates own oxygen from replaceable chemical canister. Light, comfortable. U.S. Bureau of Mines Approved.

M·S·A MINEPHONE COMMUNICATION SYSTEM—Improves haulage efficiency, safety. Messages dispatched instantly to all motormen, who can receive and reply while trips are in motion.

You'll want to see, and learn—first hand—the benefits this M·S·A equipment can bring to your mining operation by helping your efforts to step up mine production and increase over-all mine safety. Come in and discuss your special problems in Booth 1009—Coal Snow. We'll be looking for you.

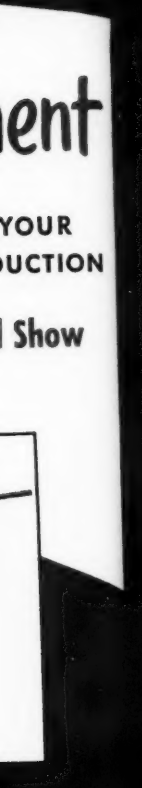
MINE SAFETY APPLIANCES COMPANY

201 North Braddock Avenue
Pittsburgh 8, Pa.

82 Branch Offices in the United States and Canada

When you have a safety problem, M·S·A is at your service. Our job is to help you.

MSA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